Engineering Library

The Engineer

DEC 7 1943

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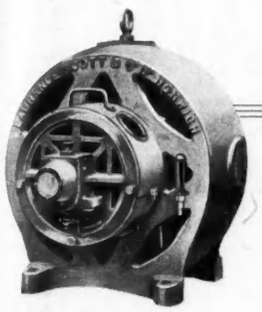
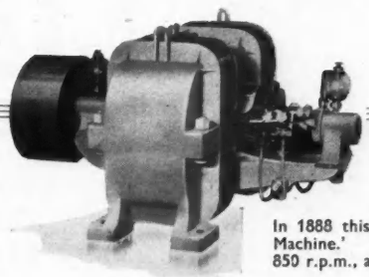
Established 1856 Price One Shilling, by Inland Post 1s. 3d. Registered as a Newspaper



The 1900 type motor, one of the first to have a reasonable degree of protection

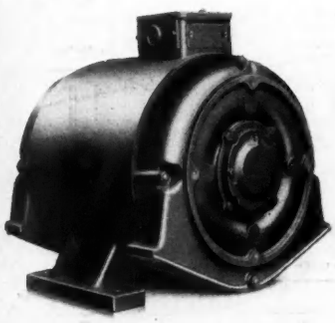


In 1888 this was 'Scott's new C Type Machine.' It developed 12 kW. at 850 r.p.m., and weighed nearly 1300 lbs.

PROGRESS . . . .

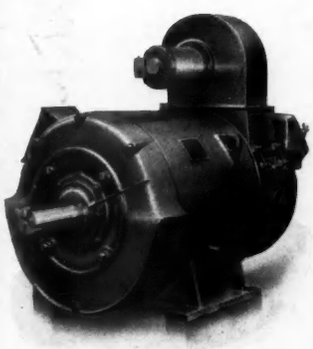
When we receive orders for spares for machines made forty or fifty years ago, as happens quite frequently, we sometimes wonder what we could offer today that would improve on the performance of such veterans.

For similar conditions of use, obviously we could not promise much more satisfactory service. Fifty years ago, however, requirements were simpler. Customers did not expect to be able to buy motors fit for trouble-free service in a steelworks or a North Sea trawler, in a fiery mine, or in choking dust or corrosive fumes. The idea of a motor mechanically designed to form a part of the driven machine was almost unknown. The need for variable speed A.C. motors had not arisen in a D.C. world; and industry had yet to learn how electric power could be controlled and regulated to drive paper mills, printing presses, and a hundred more special machines.

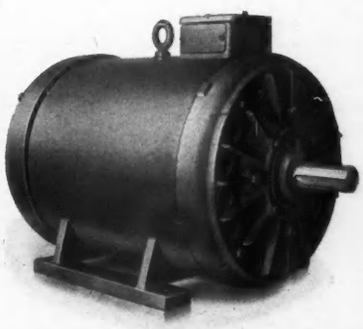


The current medium-size A.C. motor, incorporating all the mechanical and electrical features proved necessary for industrial use

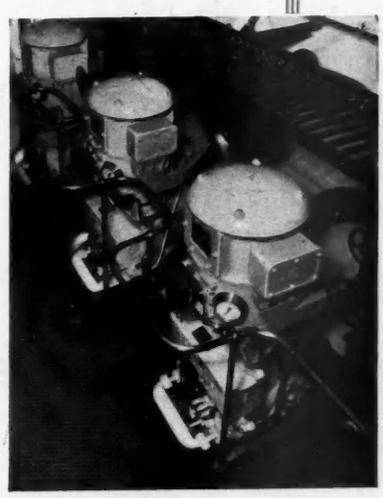
Yes, makers of electric motors have served industry well; and L.S.E. are proud to be counted with the leaders in their field.



An example of L.S.E. types for special requirements—an 'N-S' variable speed A.C. commutator motor



The latest form of the advanced 'EMCOL' enclosure—the most efficient cooling system for totally enclosed motors



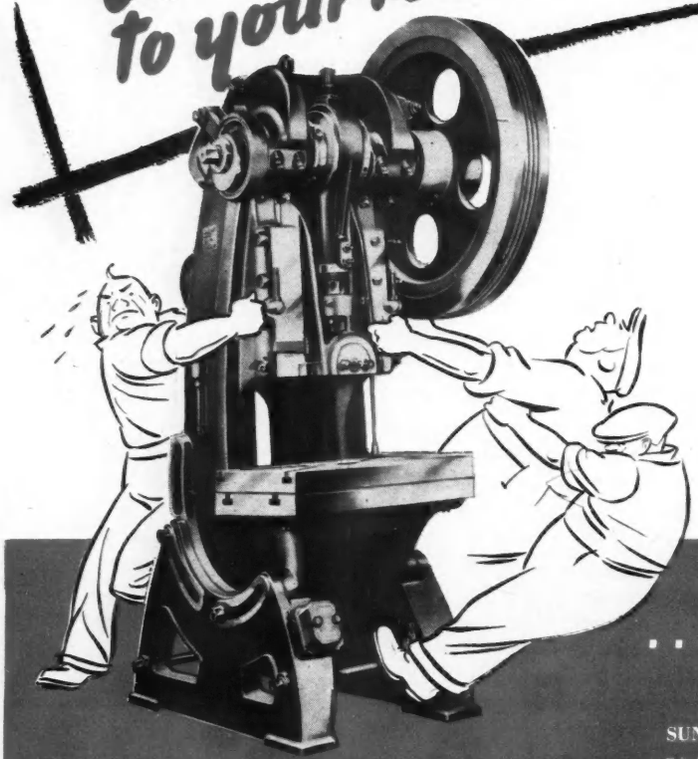
An example of L.S.E. marine types—vertical spindle motors driving fuel pumps in one of the latest and largest ships launched before the war

L.S.E.

LAURENCE, SCOTT & ELECTROMOTORS LTD

NORWICH, MANCHESTER, LONDON & BRANCHES

Don't hang on to your redundant



PRESSES

& SHEET METAL WORKING MACHINERY

They are wanted for work in the NATIONAL INTEREST

ONE OF THE 600 GROUP OF COMPANIES

Offer them to . . .

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SUNBEAM ROAD · PARK ROYAL · LONDON · N.W.10

Telephone: WILLESDEN 0944 Telegrams: OMNITOOLS, HARLES, LONDON

AND AT: LEEDS BIRMINGHAM SHEFFIELD MANCHESTER SOUTHAMPTON BATH SWANSEA NEWCASTLE Etc. ESTABLISHED 1

"Into Battle"

We are indebted to Messrs. Henry J. Coles Ltd., of Derby, for the loan of this illustration and for permission to reproduce it

Standing by for action.

On with the job.

Ready for the next.

So it goes on.

Coles' Cranes play their part. So, too, do the Wire Ropes fitted to them, which, when made from BRYANISED Wire, provide the strongest possible defence against corrosion

BRITISH ROPES LIMITED

Manufacturers of Wire Ropes, Wire, Hemp Cordage

BRYANISING *the last word in Galvanizing*

HEAD OFFICE DONCASTER. OFFICES & WORKS THROUGHOUT GREAT BRITAIN

The Engineer

LONDON, FRIDAY, NOVEMBER 5, 1943.

PUBLIC NOTICES

WHITTINGHAM MENTAL HOSPITAL, NR. PRESTON

TENDERS FOR A LANCASHIRE BOILER

The Committee of Visitors invites TENDERS for a LANCASHIRE BOILER of about 9ft. diameter by 30ft. in length, with flues removed, for use as a hot water storage vessel, installed on end. State the stipulated hydraulic test pressure, which should not be below 70 lb.

Tenders should be forwarded to the CLERK AND STEWARD, COUNTY MENTAL HOSPITAL, WHITTINGHAM, NEAR PRESTON, in a sealed envelope, endorsed "Tender for Hot Water Storage Vessel," but not bearing any name or mark indicating the sender, so as to be delivered on or before November 15th, 1943. 8518

SUDAN GOVERNMENT RAILWAYS

TWO DISTRICT LOCOMOTIVE SUPERINTENDENTS

Sudan Railways Require the SERVICES of TWO DISTRICT LOCOMOTIVE SUPERINTENDENTS, age 30-35 years. Candidates must be fully qualified Locomotive Engineers, both in theory and in practice. Must be graduated in Mechanical Engineering from a University and/or must be a Corporate Member of the Institution of Civil Engineers or of the Institution of Mechanical Engineers; must have served an apprenticeship or pupilage of not less than four years on a railway or with a firm of Locomotive builders of repute; and must have had a position of responsibility in Locomotive engineering for not less than one year.

1943:

Either (1) Starting rate of pay, £E480-540 per annum (£E1 equals £1 0s. 6d.), according to qualifications and experience, with periodical increases of pay in accordance with Government scales, viz., £E480-540-600-660-720-780-852-936, increases being biennial, with the exception of the last one which is triennial. Selected candidates will be appointed on Probationary Contracts for two years, and subscribe to the Provident Fund, after which, if accepted to serve towards pension, their contributions will be transferred to the Pension Fund.

Or (2) Short-term contract for two years, which may be extended for further periods. Pay, £E600-720 per annum, according to age, qualifications and experience. A bonus of one month's pay for each completed year of service will be paid at the termination of the contract.

Free passage on appointment. Strict medical examination. At present there is no income tax in the Sudan.

Applicants should write to the MINISTRY OF LABOUR AND NATIONAL SERVICE, CENTRAL (TECHNICAL AND SCIENTIFIC) REGISTER, ALEXANDRA HOUSE, KINGSWAY, LONDON, W.C.2, for the necessary application forms. Reference number C.1680 must be quoted. 8502

SUDAN GOVERNMENT RAILWAYS

ASSISTANT ENGINEER

Overseas Employment.—SUDAN GOVERNMENT RAILWAYS REQUIRE the SERVICES of an ASSISTANT ENGINEER, age 25 to 32, preferably unmarried. If married, wife will not be able to accompany him to the Sudan for the period of the war.

Essential qualifications are:—Physical fitness (subject to strict medical examination), personality and potential aptitude for control of staff. Candidates must have passed the Examination for Associate Membership of the Institution of Civil Engineers or hold an Engineering Degree recognised as granting exemption from sections "A" and "B" of the A.M.I.C.E. Examination. Practical Engineering Experience essential and Railway Experience desirable.

Initial starting rate of pay, £E480-660 per annum (£E1 equals £1 0s. 6d.), according to age and qualifications, with periodical increases of pay in accordance with Government scales, viz., £E480-540-600-660-720-780-852-936, all increases (except one) biennial, with the exception of the last one which is triennial. Free passage on appointment. At present there is no income tax in the Sudan.

Successful candidate will be appointed on Probationary Contract for two years, and subscribe to the Provident Fund, after which, if accepted to serve towards pension, his contributions will be transferred to the Pension Fund. Applications, giving full particulars of age, qualifications, experience, and name of present employers, should be sent to the MINISTRY OF LABOUR AND NATIONAL SERVICE, CENTRAL (TECHNICAL AND SCIENTIFIC) REGISTER, ALEXANDRA HOUSE, KINGSWAY, LONDON, W.C.2, quoting reference No. E.783. 8503

The Engineer

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THE FACT that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.

PUBLIC NOTICES

BOROUGH OF HENDON

APPOINTMENT OF FOREMAN MECHANIC AT ISOLATION HOSPITAL

Applications are Invited for the above APPOINTMENT from persons not liable for service with H.M. Forces. Applicants must be thoroughly experienced in the Maintenance Appliances used in connection with a Hospital.

Salary will be at the rate of £300 per annum, rising by annual increments of £20 to a maximum of £340, plus war bonus as approved by the Council (at present £45 10s. on the commencing salary).

Subject to the passing of a medical examination and being otherwise eligible, the person appointed will be included in the Superannuation Scheme established under the Local Government Superannuation Act of 1937.

Particulars of duties and application form can be obtained from the Borough Engineer, Town Hall, Hendon, N.W.4, and applications must be received by the undersigned not later than Wednesday, 24th November, 1943.

Canvassing, directly or indirectly, will be a disqualification.

Dated this 29th day of October, 1943.

L. WORDEN,
Town Clerk.

Town Hall,
Hendon, N.W.4. 8521

PUBLIC NOTICES

JOHN MACMILLAN ANGUS,
Marine Engineer, late of Glasgow.

Take Notice that a PETITION has been PRESENTED in the Sheriff Court, Glasgow, to DISPOSE of a LEGACY falling to him from John Angus' Trust, and to have his death presumed on or before 1st October, 1943.

Claims to be lodged with the Sheriff Clerk, Glasgow, within one month of this notice.

JAMES K. WALKER,
Solicitor.

98, West George Street,
Glasgow, C.2.
Pursuer's Agent. P6415

THE INSTITUTION OF CHEMICAL ENGINEERS

EXAMINATION, 1944

Application Forms Returnable 1st December, 1943, and particulars of the ASSOCIATE MEMBERSHIP EXAMINATION for 1944 may be obtained from the HON. REGISTRAR, INSTITUTION OF CHEMICAL ENGINEERS, 56, VICTORIA STREET, WESTMINSTER, LONDON, S.W.1. 8371

PUBLIC NOTICES

ROYAL AIRCRAFT ESTABLISHMENT

HEADMASTER FOR TECHNICAL SCHOOL

A Headmaster is Required for the Technical School of the above Establishment. This day school comprises an established, but expanding, Apprentice School for engineering and trade apprentices, taking National Higher National, and City and Guilds Examinations, and a School for the further education of juvenile and laboratory assistant employees.

The latter School is a new development to provide further education for juvenile employees and courses for young laboratory assistants to prepare them for the Associate Fellowship Examinations of the Royal Aeronautical Society.

SALARY, appropriate Burnham Scale.

Candidates for this Headmastership should have Academic Qualifications to the standard of a University Degree in Engineering, preferably Honours, and some Practical Engineering and Teaching experience. Experience in the Administration of Technical School Work and some knowledge of Aeronautics is desirable.

Write, stating age, full particulars of qualifications and experience, and name and address of present employer, to MINISTRY OF LABOUR AND NATIONAL SERVICE, CENTRAL (TECHNICAL AND SCIENTIFIC) REGISTER, D SECTION (D700), ALEXANDRA HOUSE, KINGSWAY, LONDON, W.C.2. 8520

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

TO ADVERTISERS UNDER BOX NUMBERS IN SITUATIONS OPEN SECTION.

For the benefit of applicants, the Proprietors are prepared to insert brief notices that vacancies are filled, upon receipt of notifications from the Advertisers. These notices (limited to one line) will be free of charge, and co-operation is asked for.

IMPORTANT

Advertisers in Situations Open Column should make themselves acquainted with the terms of

STATUTORY RULES & ORDERS 1941 No. 2069

RESTRICTION ON ENGAGEMENT ORDER

CHEMICAL ENGINEER, NORTH MIDLANDS. — MANUFACTURERS have VACANCY on Technical Sales Staff for CHEMICAL ENGINEER. Applicants should be University Graduates, and have had wide experience of Chemical Manufacturing and Allied Industries.—Address, stating age, experience, and salary required, 8507, The Engineer Office. 8507 A

DEPARTMENTAL MANAGER REQUIRED for Heat Treatment Department, Steel Works, North Midlands; must have had previous experience and technical education, capable and organising ability, and experienced in Labour Control (this is important). Permanent position. Salary £600 per annum. State age and experience chronologically.—Address, P6420, The Engineer Office. P6420 A

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CLASSIFIED ADVERTISEMENTS CLOSE FOR

PRESS-NOON WEDNESDAYS

The Engineer

Annual Subscription Rates

(including postal charges)

BRITISH ISLES	£3 5 0
CANADA...	£2 12 6
ABROAD...	£3 3 0

(except Canada)

ADVERTISEMENTS

The Charges for Classified Advertisements are 1/6 per line up to one inch—minimum charge, 6/-; those occupying one inch or more at the rate of 18/- per inch. Box numbers, 1/- extra, except in the case of advertisements under "Situations Wanted." Orders MUST be accompanied by a remittance. The rates for Displayed Advertisements will be forwarded on application. Classified Advertisements cannot be inserted unless delivered before TWO o'clock on Wednesday afternoon.

Letters relating to the Advertisement and the Publishing Departments of the Paper are to be addressed to the Publisher; all other letters are to be addressed to the Editor of THE ENGINEER.

Postal Address,
28, Essex Street, Strand, London, W.C.2.

Telegr. Address,
"Engineer Newspaper, Estrand, London."
Tel., Central 6565 (10 lines).

SITUATIONS OPEN

ENGINEERING MANAGER REQUIRED by a Large Heavy Chemical Works on essential work in N.W. Region, employing a considerable maintenance and constructional staff. Applicants should be Graduates in Mechanical Engineering and must possess thorough knowledge of Boiler and Generating Plant, also Mechanical Handling Equipment for Heavy Raw Materials. Previous executive experience essential. Age 33–38. The post is a permanent one and carries a substantial and progressive salary.—Address, giving full particulars of training and experience, also salary required, 8476, The Engineer Office. 8476 A

ENGINEER REQUIRED by Professional Organisation. Must be trained Methods and Time Study Engineer. Only applicants possessing good qualifications and applied practical experience need apply. Good prospects and salary for successful applicants.—Address, stating age, qualifications, detail of experience, salary required, and references, 8517, The Engineer Office. 8517 A

EXPERIENCED COST ACCOUNTANT REQUIRED for Precision Engineering Firm, Home Counties, employing about 400 operatives. Full particulars and salary required.—Address, 8515, The Engineer Office. 8515 A

FIRM Designing and Manufacturing Process Plant for Food and Chemical Industries and well established in home and foreign markets, REQUIRE high-grade CHEMICAL ENGINEER, aged 30 to 40, with thorough scientific outlook, inventive capacity, and commercial sense. Varied duties include exhaustive Technical Study of Industries served by the company, so as to be able to lead and advise the technicians of those industries on plant and processes. Applicant must possess or achieve such standing in scientific and industrial research as to keep the firm in the forefront of technical advisers and plant designers for each industry served and be able to direct the activities of the firm's own physical, chemical, metallurgical, and design departments and existing high-grade technologists and specialists of the firm. Knowledge of foreign languages desirable. Ultimately seat on board available.—Address, with full particulars, 8505, The Engineer Office. 8505 A

JOINT MANAGER for Small General Steel Erection Engineering Company. Keen, creative, and a good organiser to work up business. Able to Obtain, Develop, and Supervise New Branches of Construction Work. Opportunity for man with energy and ability to share in profits after trial period at nominal salary.—Write, giving full particulars, to Box P.845, Willings, 362, Gray's Inn Road, London, W.C.1. 8512 A

MACKAY (AGENCIES), LTD., Factors in every type of engineering plant and equipment, importers and exporters of all types of similar equipment, with a constantly increasing turnover and large established facilities for handling same, have a VACANCY for a GENERAL MANAGER. The position carries considerable responsibility.

Candidates must have first-hand knowledge of Markets and Regulations affecting this type of business, and preferably have had at least part of their training in Mechanical Engineering.

The appointment will necessitate working between the provincial offices and the London office of the organisation, with direct contact with suppliers, customers, and all Government Departments concerned, and carries exceptional prospects.

Applicants will only be considered from written communications in the first place, which should fully set out present position, salary, and exact appointment held, together with full details of age, education, and other relevant matters, and should be addressed "For the attention of the Managing Directors," MACKAY (AGENCIES), Ltd., Colwall, Malvern, Worcs. 8498 A

PRODUCTION ENGINEER REQUIRED by an Engineering Firm in North-West to Take Charge of Production Planning in Rolling Mills and Constructional Engineering Sections.—Applicants should hold a recognised engineering qualification, and should write to MINISTRY OF LABOUR AND NATIONAL SERVICE, Central (Technical and Scientific) Register, Alexandra House, Kingsway, London, W.C.2, for the necessary application forms, stating the salary required. The reference number C.1787 X must be quoted. 8504 A

SITUATIONS OPEN

REQUIRED, A.R.P. SUPERVISOR for Factory in Bucks. Ex-Officer preferred, but not essential.—Address in first instance, stating particulars of qualifications and approximate salary required, 8506, The Engineer Office. 8506 A

SALES ENGINEER ASSISTANT WANTED, controlled (E.W.O.) firm; must be good Technical Correspondent, with Engineer Training in Structural and Fabricated Products.—Write, giving full details, COMMERCIAL STRUCTURES, Ltd., Staffa Works, Leyton, E.10. 8446 A

SHEET METAL and CONSTRUCTIONAL PLATE WORKS REQUIRE a WORKS MANAGER; must be fully conversant with Setting Out, Development, Estimating, Planning, and Modern Job Costing Methods; also must have an appreciation of requirements various Orders.—Address, 8523, The Engineer Office. 8523 A

THE Post You Are Seeking May Not Be Advertised in this Column, but do not lose the Opportunity of Bringing your Requirements before all those who would be interested and could employ you. An Advertisement in the "Situations Wanted" Column would be seen by all Leading Engineering Concerns for the cost of Four Lines, 6s.; 1s. 6d. for each Additional Line. There is no better way of covering so large a field for such a small charge.

SITUATIONS WANTED

ADVERTISER, 30 Years' General Engineering experience, including 18 years as works or general manager on heavy and light production work, SEEKS NEW APPOINTMENT. Experience covers designing, estimating, rate fixing, and progressing; works planning and machine loading on all types of machine tools; toolroom work, foundry work, heat treatment, welding and sheet metal work, hardness testing, and inspection work. Keen, organiser, and strict disciplinarian. Experienced in incentive bonus schemes. Age 51. Salary about £1000. Free end November, 1943.—Address, P6422, The Engineer Office. P6422 B

A.M.I.B.F. (39), Single, Healthy, Well educated, nine years' executive experience, estimating, planning, pattern design for machine moulding production, and all foundry departments, SEEKS RESPONSIBLE PROGRESSIVE SITUATION, Advisory, Technical, or Executive, home or abroad.—Address, P6425, The Engineer Office. P6425 B

A.M.I. MECH. E., All-round Experience with firms of international repute, proved ability in organisation, possessing initiative and personality, conversant with latest methods of production, British and Continental, covering many branches of engineering, DESIRES JOIN progressive FIRM to Develop Schemes for post-war expansion.—Address, P6426, The Engineer Office. P6426 B

CHARTERED CIVIL ENGINEER (42), Wide exp. design and execution docks and harbour works, airfields, irrigation, river control, &c., SHORTLY AVAILABLE for RESPONSIBLE POST giving scope for initiative.—Address, P6418, The Engineer Office. P6418 B

CHEMIST, Age 26, Pass B.Sc. (Special) (London), SEEKS SITUATION with reputable company. Analytical research, experience chemical engineering plant and labour management. Permanent progressive situation essential.—Address, P6413, The Engineer Office. P6413 B

COST CONTROLLER, ACCOUNTANT, &c.—POSITION REQUIRED by Chartered Accountant (38), with considerable executive experience in engineering and allied industries. Production and material control, personnel management, production committees, &c., short-period accounts, all costs, budgetary control, &c. Extensive reorganisation. Salary £1250/£1500.—Address, P6409, The Engineer Office. P6409 B

DESIGN and PRE-PRODUCTION ENGINEER, age 33 years, immediately available, administrative experience in D.O., workshops, progress and development, &c., in aircraft and light mechanical engineering, sound technical qualifications; similar POST REQUIRED.—Address, P6403, The Engineer Office. P6403 B

ENGINEER, B.Sc., A.M. Inst. C.E., with civil and mechanical, construction and production experience, DESIRES POST as Production Manager or equivalent. Minimum initial salary £1000. Age 41. Only interested in progressive job.—Address, P6397, The Engineer Office. P6397 B

ENGINEER EXECUTIVE, Technical and practical experience, steam, marine, aircraft, tractor and general engineering, specialities project development, organisation and standardisation; available immediately. Permanent or consultant.—Address, P6362, The Engineer Office. P6362 B

ENGINEER, M. Inst. B.E., A.M.I. Mech. E., CAN BE AVAILABLE for MANAGERIAL POST requiring wide experience; part Continental, managerial, technical, practical, heavy, medium, light production; good organiser, cost reducer, expert tool designer, modern methods, mass production; highest testimonials.—Address, 8463, The Engineer Office. 8463 B

EXPERIENCED ENGINEER (40) SEEKS POST as Tool Room Foreman or as Works Manager with small progressive firm. Available now. Essential work. London area preferred.—Address, J. G., 107, Lyon Park Avenue, Wembley. P6424 B

SITUATIONS WANTED

ENGINEER, Industrial and Mechanical (Dr.-Eng.), age 43, wide experience, technical and commercial ability, very progressive, good organiser. Experience in overseas developments, group production, co-ordination, and planning. Training in great electrical and industrial concerns. Perfect knowledge five modern languages. Disposed also TAKE CHARGE or CONTROL ORGANISATIONS abroad. Release obtainable.—Address, P6416, The Engineer Office. P6416 B

HEATING AND VENTILATING ENGINEERING.—ADVERTISER would like to CONTACT FIRM contemplating Opening of Post-War Branch in East Yorkshire, either as Consultants or Contractors, with view to management.—Address, P6423, The Engineer Office. P6423 B

IF the Man You Are Seeking is Not Amongst those Advertising in this Column, a Small Announcement in the "Situations Open" Column will Quickly and Economically Produce the Right Selection of Applicants, at the same time Eliminating Waste of Effort, Waste of Time, and Waste of Opportunity. The charge is Four Lines or under, 6s.; each Additional Line, 1s. 6d. Box Numbers, 1s. extra, which includes despatch of all replies.

OPEN for IMMEDIATE APPOINTMENT as Works Manager or Senior Executive; 18 years' executive exp. in production and labour control, jig, tool, die design and making for mass or small quantity production of ferrous and non-ferrous alloys by machine, press, mould, &c. Press tool and methods expert.—Address, P6421, The Engineer Office. P6421 B

POSITION REQUIRED as PRODUCTION MANAGER or PRODUCTION ENGINEER; over 20 years' experience, technical and practical; sound knowledge modern production methods and organisation; min. salary, £800.—Address, P6387, The Engineer Office. P6387 B

QUALIFIED ENGINEER (41) AVAILABLE for POSITION of GENERAL MANAGER or CONSULTANT, preferably with lead to Directorship. Positions held with well-known firms: designer, technical assistant, departmental manager, works manager, assistant to managing director, sales manager, consultant. Sound practical, technical, and commercial experience, including designing, lay-out, planning, rate fixing, jig and tool work, production, material, pay and cost control systems, purchasing, works and sales organisation. Handled union and non-union shops, male and female labour. Versed in company and patent law and procedure, world travelled, produced 32 commercially successful engineering patents and can introduce specialised protected lines for personally known home and export markets, if required.—Address, P6428, The Engineer Office. P6428 B

RESEARCH PHYSICIST, Honours Graduate, will UNDERTAKE TECHNICAL TRANSLATIONS from Dutch, French, German, and Italian.—Address, P6419, The Engineer Office. P6419 B

STRUCTURAL ENGINEERING.—MANAGER, 20 years' experience, all classes structural and general engineering on North-East Coast, relinquishing present position of executive control of sales, designing, production and erection, REQUIRES POSITION. Special experience general organisation and progressive production control.—Address, P6417, The Engineer Office. P6417 B

MACHINERY, &c., WANTED

WANTED, 3ft. to 4ft. GUILLOTINE, ¼in. cap. Particulars.—Address, 8526, The Engineer Office. 8526 F

WANTED, 3-Ton STEAM LOCO. CRANE, 25ft. jib, standard gauge. Full particulars.—Address, P6414, The Engineer Office. P6414 F

WANTED, ONE SET ROTARY SHEARING MACHINE, to cut up to ¼in. plate. Price and full particulars to COX and DANKS, Ltd., Hurlingham Wharf, Carnwarth Road, S.W.6. 8473 F

WANTED, 7/8-Ton STEAM LOCO. CRANE, 4ft. 8½in. gauge, short wheel base, long jib. In working condition.—Address, 8474, The Engineer Office. 8474 F

We are licensed by the Machine Tool Control for the purchase of all classes of Machine Tools, and we offer good prices for surplus Machinery in any quantities, large or small.
(Machine Tool Control Licence No. 172.)

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359, EUSTON ROAD, LONDON, N.W.1
Telephone No. - EUSton 4681 (10 lines).
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ALFRED HERBERT, Ltd., Coventry, PAY BEST PRICES for SECOND-HAND MACHINE TOOLS in good condition by first-class makers.

Write, wire, or 'phone, and our representative will call. Authorised Dealer's Certificate No. 71. 'Phone: 88781 (20 lines), Coventry; Telegrams: "Lathe, Telox, Coventry." 1002 F

ALL Classes of MACHINE TOOLS WANTED, cash paid.—NORMAN E. POTTS, 105, Alcester Road South, Birmingham, 14. 8528 F

SUB-CONTRACTING

WANTED

DRAUGHTSMAN REQUIRES SPARE-TIME WORK (20 hours). Designing, lay-out, working drawings, &c. Moderate charges. Address, P6427, The Engineer Office. P6427 B

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A Seven-Day Journal

Standing Consultative Conference on Fuel Research

THE Standing Consultative Conference on Fuel Research which has been constituted by the Department of Scientific and Industrial Research to promote collaboration among the various research associations or equivalent organisations engaged on fuel research, and between them and the Department's Fuel Research Organisation, had a preliminary meeting on Thursday, October 21st, 1943. In the absence of the Chairman, Sir Harold Hartley, through illness, Sir Edward Appleton presided over the meeting at which representatives of the Ministry of Fuel and Power, the British Coal Utilisation Research Association, the British Electrical and Allied Industries Research Association, the British Refractories Research Association, the Gas Research Board, British Iron and Steel Federation (Industrial Research Council), British Hard Coke Research Association were present. In his opening remarks Sir Edward Appleton briefly described the objects which the Department had in view in setting up the Conference, and emphasised that membership is voluntary, and at the invitation of the Department. The Conference is intended to provide a convenient means whereby the research organisations may keep in close touch with each other, and assist each other by interchange of information and by friendly discussion. Members of the Conference described briefly the aims and scope of their organisations, and then discussed arrangements for the setting up of a central body to undertake the preparation and publication of abstracts of current literature relating to fuel and the maintenance of a register of translations.

Shipbuilding Outputs in America

IN a speech made in America on September 24th, on the occasion of the second anniversary of the launching of the first "Liberty" ship, the "Patrick Henry," Admiral Land, the Chairman of the United States Maritime Commission, took the opportunity to review the progress made in American shipyard output during the last two years. He stated that in September, 1941, there were but twenty-one shipyards in which ships were being built on about 100 berths. In September this year the number of shipyards had risen to seventy and more than 300 launching ways were in use. The output during September, 1941, was seven ships, totalling about 64,000 tons deadweight carrying capacity. Last September over 160 ships were completed, totalling in deadweight well over 1½ million tons. The cost of building ships had steadily decreased, and there had been a rapid increase in the number of workmen employed in shipyards, which had risen from 200,000 two years ago to three-quarters of a million men and women now employed in shipyard work, and more than one million employed in plants producing the materials needed for ship construction. Progress was measured in the speed with which ships were being turned out. The first "Liberty" ship was laid down 151 days before she was launched, and her fitting out required ninety-four days, making a total of about 245 days after the laying of the keel plates. To-day, "Liberty" ships were being built in about forty-five days.

America's 1944 Shipbuilding Programme

ADMIRAL LAND then went on to deal with the 1944 programme of ship construction in America. In many yards, he said, production was going over from "Liberty" ships to the faster "Victory" ships, but the production of "Liberty" vessels would not entirely cease. The number of "Victory" ships to be built in 1944 was 339, and the number of "Liberty" ships 820. In addition, 300 "C" type cargo-carrying ships would be built and 340 oil tankers, making in all a grand total of 1799 ships. Referring to the differences between the two kinds of ships, the "Liberty" and the "Victory," the Admiral pointed out that both ships had a deadweight carrying capacity of about 10,800 tons, but whereas the propelling machinery of the "Liberty" ships consisted of triple-expansion engines, taking steam from Scotch and water-tube boilers, the machinery for the "Victory" vessels would be geared steam turbines, taking steam from water-tube boilers, probably, we are given to understand, of the Babcock and Wilcox and Foster Wheeler types. Admiral Land spoke of the speed of the "Victory" ships as about 15 to 17 knots, or 4 to 5 knots faster than the "Liberty" ships. It was recognised, he said, that the "Victory" ships, with their faster speeds, would be more competitive units for the post-war shipping trade. Summarising the number of ships produced from the beginning of the shipbuilding effort, together with those provided for in the 1944 programme, Admiral Land stated that in all close upon 50 million tons deadweight carrying capacity, corresponding to a gross tonnage of close upon 34 million, would have been completed by the end of 1944.

The "Avro York" Transport Aircraft

THE Air Ministry has now released certain particulars regarding the design of the new "Avro York," which is a transport version of the "Lancaster" bomber. Like the bomber, it is a high-wing four-engine monoplane. The wing span is 102ft., with an overall length of 78ft. The power plant consists of four Rolls-Royce liquid-cooled engines. The principal differences between the "Avro York" and the "Lancaster" consist in the different shape of the fuselage and the triple-fin tail unit of the transport machine. The fuselage has been specially laid out for the carriage of passengers or freight. The general design of the "Lancaster" wings and engine nacelles has been retained in the "York" and the individual rudder and fin design is similar in both aircraft. The internal arrangement of the fuselage has been carefully designed to permit a quick and convenient conversion for the purpose of all-passenger-carrying machines or the carrying of an all-freight cargo, or a mixed cargo. By means of large hatches which form part of the fuselage large and bulky consignments may be readily handled. The "Avro York" is so designed that it can be equally well employed either for short-haul traffic or for a long-distance aircraft. More than fifty passengers are carried when it is employed on short-range work.

Planning of the Gas Industry

SOME interesting proposals for the planning of the British gas industry are put forward in a report which has been submitted to the Minister of Fuel and Power by the British Gas Federation. For two years a committee has been sitting in order to collect and collate relevant information and to consider the steps to be taken by the industry in order to place it upon such a basis that it can best meet the altered conditions of the future and make the largest possible contribution to national and social welfare. The submission of the resulting report has been agreed upon by an overwhelming majority of those representing the industry. The report recommends that the Ministry of Fuel and Power should appoint a National Fuel Advisory Council to facilitate the elimination of wasteful competition among the fuel industries and the substitution of co-operation in the national interest. Other recommendations are designed to secure the review and revision of gas legislation, to free the industry from out-of-date restrictions, and to support integrating facilities to expedite and co-ordinate—where increased efficiency would result—the rational merging, joint operation, or association of gas undertakings or their co-operation in specific activities. Functional integration will be effected by a new British Gas Association—a merger of the National Gas Council and the British Commercial Gas Association—whose Central Council will be the "Parliament" of the industry. Undertakings will be represented on appropriate District Councils, which will elect the Central Council. Boards and committees will be appointed to deal with specific problems, and there will be separate committees concerned with the particular interests of company and municipal undertakings. To meet the imperative need for the adoption of agreed costing systems, and the compilation of general statistics, a Statistical Bureau will be formed by the Association.

Shipping Lines and Air Services

ON Tuesday morning, November 2nd, it was announced that five shipping lines trading between this country and South America are to form a separate company for the purpose of operating air services between the United Kingdom, the Continent, and South America. Action is to be taken as soon as aircraft are available and the necessary consents have been obtained. The companies interested in this new project are Royal Mail Lines, Ltd., the Blue Star Line, Ltd., the Pacific Steam Navigation Company, the Booth Steamship Company, Ltd., and the Lamport and Holt Line, Ltd. It will be recalled that early last month the General Council of British Shipping announced that replies to questions sent to the various British shipping companies clearly indicated that these companies were in favour of an immediate and substantial interest in future air services, and the Council had made arrangements for those interested in these proposals to work out their own proposals through the appropriate organisation. The Council also decided that it would continue to be responsible for submitting to the Government the proposals worked out by the different shipping groups in the industry, and that it would also continue to press for the right of shipowning firms as a whole to take their share in the future development of air transport. Several shipping companies have already obtained the necessary powers to operate air services.

Salvage and Industry

AT a conference on industrial salvage, held at the Guildhall, Worcester, on Wednesday, October 27th, Mr. C. U. Peat, the Joint Parliamentary Secretary to the Ministry of Supply, spoke on industrial salvage and the necessity of continuing that effort after the war. Two important items were, he said, light ferrous scrap and scrap rubber. In both these cases we had, by our salvage efforts, been able to accumulate a satisfactory stock position, and possibly some changes in policy and procedure would be necessary. The Minister of Supply would be shortly making a further announcement on the collection of light metal scrap. Since February, 1942, over 200,000 tons of rubber scrap had been collected, and after meeting the needs of our reclaiming works and exporting many tons to America we still had quite a nice stock laid by. There was an urgent need of effort in the collection of paper and books, rags, bones, and non-ferrous metals of all kinds. Other important items were waste lubricating oils, anodising liquors, saponified linseed oil, effluent greases, and various waste products, which could replace more valuable material as foundry core compounds. Other items no less important included electric lamp bulbs, radio valves, abrasives and grinding wheels, and a whole range of containers, whether made of timber, metal, fibre board, or glass. All these items were urgently required. Mr. Peat then went on to describe the progress made with the organisation of industrial salvage and the different groups formed. Floor sweepings may prove a useful source of valuable material. Hundreds of tons of valuable alloys are lost every week because of poor segregation in factories and scrap yards. Good progress has been made by the Container Recovery Service, which is now recovering serviceable containers, mainly of fibre and wood, to the extent of 200,000 every week.

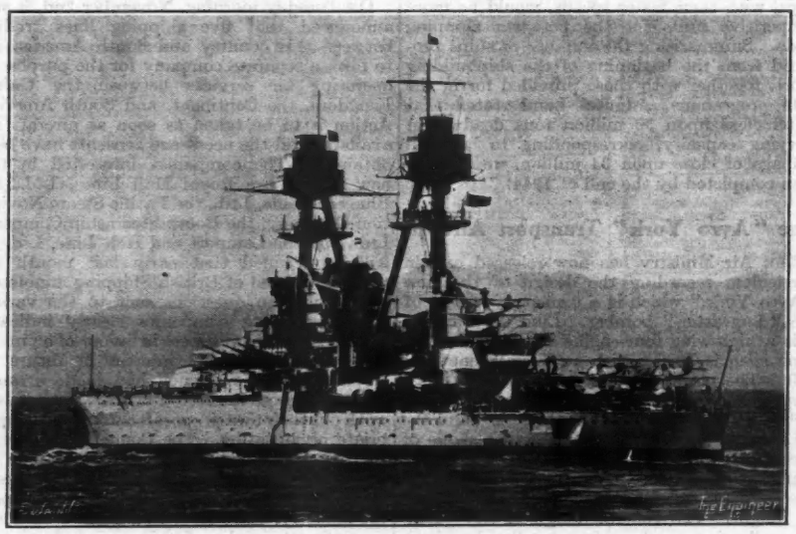
Salvage at Pearl Harbour

(By an American Correspondent)

No. III—*(Continued from page 339, October 29th)*

Salving the "Oklahoma"

THE capsized 29,000-ton battleship "Oklahoma" has in some ways placed the biggest problem on the shoulders of the salvors, for she had settled into the water bed with her bottom uppermost. She is the sister ship of the "Nevada," and was first placed in service in the spring of 1916. Although not an up-to-date craft of her class, she is, nevertheless, fairly heavily armed and a battlecraft of considerable potential value. During the Japanese attack she was struck repeatedly with bombs and torpedoes, and many of her compartments became flooded, so that she eventually heeled over and capsized in deep water. Her plunge was an abrupt one, and, because she turned turtle in seven or eight minutes, she carried down with her nearly 400 of her complement. The ship came to rest on her port side with a list of 150 deg. from the vertical, and became partly embedded in the mud which was squeezed through every opening that offered a passageway, and increased correspondingly the difficulties that had to be contended with by the divers sent into her to make examinations preliminary to planning the salvage procedure. Admission to the interior was obtained through holes cut in the undamaged, upturned starboard side. Each of these holes was fitted with an air lock, and this course was followed for each of the flooded compartments, the doors in the water-tight bulkheads of the compartments having been closed when "General quarters" was sounded. When a compartment, so equipped, was placed under air pressure it was possible to drive out fluid mud, water, and oil down to the level of the top of the uppermost hole or rent, and divers or other pressure workers—depending upon the depth of the water—could go into the ship to work, with or without diving dress of some sort, as the depth of water required. While this salvage method may sound somewhat novel, it may be recalled that very much the same thing was done in refloating and temporarily repairing—while so refloated—the steamship "Royal George," which was sunk on the rocky bed of the St. Lawrence River in November, 1913, while running at full speed and at high water, 9 miles below Quebec, Canada. Air locks, placed over certain hatchways, otherwise sealed for the purpose, made it possible to force the water down and out of the ship so as to give her sufficient buoyancy to lift her clear of the rocks, and also to enable "sandhogs" to work as they would in subaqueous tunnel-driving, while they closed the ripped bottom plating with patch plates, and so made the steamship ready, without the aid of a dry dock, for a long sea run. The precedent established in the case of the ss. "Royal George" has likewise been helpful in getting the "Oklahoma" in condition for righting and refloating. By applying compressed air to some of the compartments, it was possible to lower the water surface in certain of them as much as 20ft., and so enable men to work without wearing diving dress. When gas was present and ventilation imperfect, the men donned gas masks or a special diving and wading dress, consisting in the main of a soft rubber mask or headgear of light weight. The rubber headdress can be used either with an air line for relatively long submergences in shallow water or fitted with a flask of compressed air for short and occasional submergences where the water in a compartment might range on a sloping deck from a few inches to over the worker's head.



U.S.S. Battleship "Oklahoma"

The divers and others who entered the "Oklahoma" while she was overturned were first familiarised with the area in which each man had to work by means of a scale model, fashioned of composition board, which was built by a chief water tender in the Navy. That model was made in horizontal sections that could be lifted off to expose the interior of the craft successively downward to a given location, and the model was set up in a position duplicating that of the sunken battleship. By means of the model each diver was made familiar with the devious course that he might have to trace after entering the wreck to reach a prescribed objective. Commercial marine salvors have repeatedly made use of kindred models to guide divers who have had to enter sunken ships for one purpose or another. This was done to recover bullion in the strong-room and mail-room aboard the ss. "Empress of Ireland," which was rammed and sent to the bottom in the St. Lawrence in water 160ft. deep. The ship was struck and foundered in the spring of 1914, and she, too, rested far over on her port side. The task there was to locate a particular air port which marked the starboard end of a transverse passageway in the vessel, and then to cut a hole in the side of the ship so the divers could enter and leave her. The divers, to reach the purser's office, the main-room, and the strong-room, where a large amount of bullion was stored, had to follow a devious and sharply slanting path to reach their goals and to retrace their

U.S.S. "Oklahoma" in Process of Righting

course surfaceward on the slippery footing to the outlet in the side of the liner. The operations were carried out successfully, but it is doubtful if the work could have been completed without the loss of a number of lives but for their training for the particular job with the aid of a cardboard model that reproduced on a small scale the exact route that a diver would have to take and just what he would find on either hand at each turn.

When the "Oklahoma" had been freed of some of the water and mud within her, and otherwise lightened by the removal of weight wherever possible, and many of the holes in her had been patched or plugged, she was ready for the crucial job of righting. The contract for that work was awarded to the Pacific Bridge Company, of San Francisco, Cal., which elected to roll the ship to an approximately upright position by means of the pull to be exerted by a considerable number of electric winches which applied their power to steel cables attached to the sunken battleship. The vessel rested parallel with the nearby shore of Ford Island, on which the winches were secured in a line parallel with the length of the battleship. The cables were carried from the shore out over the upturned bottom and down around the starboard side and inboard under the wreck to any strong parts of the structure that would answer the purpose of withstanding the stresses to which the cables might be later subjected when the winches were exerting their pull, the idea being to pivot the body of the ship successively on her port rail and side as she was rotated. We are not informed how many times the cables parted or pulled loose during that tug-of-war, but it has been disclosed that about seventy hours of the use of the winches and the cables served to roll the "Oklahoma" and to pull her main deck clear of the harbour's surface. Some of the photographs of the righting of the "Oklahoma" show the cables to have been attached to many different parts of the structural body of the battleship, indicating that salvors had resorted to a catch-as-catch-can method in wrestling the ship again to a position on her back or keel. From start to completion of the rolling operation the elapsed time is said to have been six weeks. Normally, in any corresponding salvage task, it would be necessary to break the grip or seal between the water bed and a ship's bottom by jetting more or less extensively. It seems that this was not required in the case of the "Oklahoma," because of the porous nature of the mud and sand forming the substance of the bottom hugging the ship's skin. The pull of the righting cables was under exact control, and stress was applied only intermittently in rolling her gradually back to an approximately vertical posture, and even after that position was achieved, the cables were left still attached to her and held taut to prevent any reverse tipping until the battleship could be made comparatively stable by removing top weight and regulating the disposition of water in compensating subdivisions of the still partly flooded craft. The work that followed after righting was a stupendous job of cleaning, with a touch of grimness when bodies were encountered and had to be removed. Great pains have been taken to ventilate thoroughly every sunken ship during the various stages of reclamation to guard against the deadly menace of hydrogen-sulphide gas especially. This, of course, was to be expected more generally within the "Oklahoma" than in the other battlecraft that were not capsized nor so extensively submerged, with the exception of the "Utah," which has not yet been righted, but which will eventually be handled in much the same way as the "Oklahoma."

RIGHTING THE U.S.S. "OKLAHOMA"

Further Salvages

The battleship "Pennsylvania," of 33,100 tons, launched in 1915, was in one of the big graving docks, and ahead of her in the same dock were the destroyers "Cassin" and "Downes," and before that dock could be filled to refloat the vessels the Japanese struck. As long as they could do so, all three vessels resisted the enemy aircraft with machine and rapid-fire batteries. The "Pennsylvania" was hit by a bomb that did some damage to her bow, but the injury was such that repairs could be made in two weeks, and the ship declared ready for sea again. In the case of the "Cassin" and "Downes," the story is different. The "Downes" was struck by a bomb that exploded her magazine, and made her a shattered mass, while the same explosion set fire to the adjacent "Cassin" and knocked her off the blocks and on to the floor of the dry dock, and her own explosion made her a useless wreck. Nevertheless, a large percentage of the propelling machinery of those vessels was later reclaimed for re-use in new destroyers, and every bit of their torn and twisted steel was salvaged and shipped away as much-desired scrap for reworking in the United States. The destroyer "Shaw," which was in a floating dry dock, the day of the raid, was struck by a bomb that literally blasted off a large part of her forebody. Even so, that vessel was refitted with a temporary steel bow and was able to leave Pearl Harbour and to make her way under her own steam to a navy yard on the Pacific Coast, where she was again made ready for sea service.

(To be continued)

Engineers and the British Empire

By Professor MIDDLETON SMITH, M.Sc., M.I. Mech. E., LL.D.

No. XVIII—*(Continued from page 350, October 29th)*

Harbour Works in New Zealand

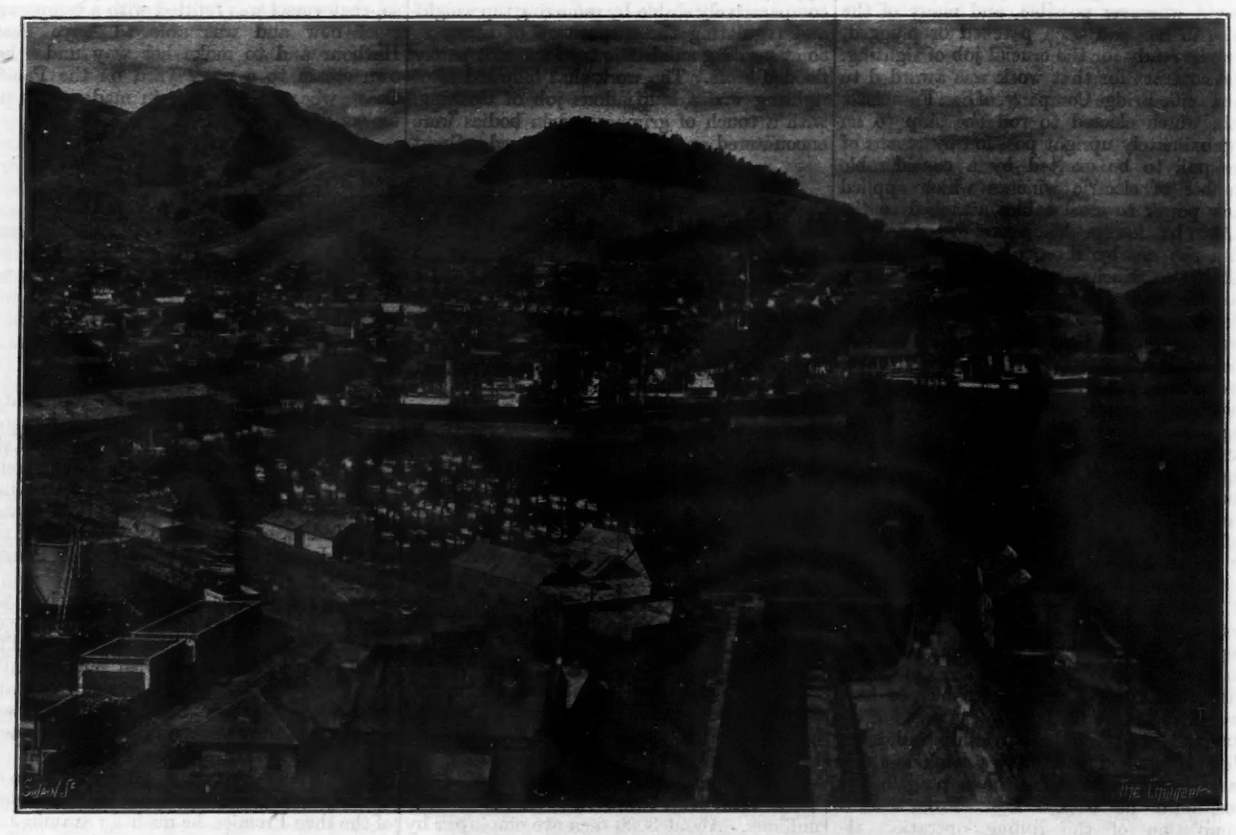
THERE are twenty-one ports of entry for Customs purposes, and numerous others. The control and management of the various harbours are vested in Harbour Boards, all with their own officials and staff and quite independent of one another. Projects that involve reclamation and wharf building must obtain the consent of Parliament, and no harbour works can be carried out without Government approval. In 1939–40 the Harbour Boards spent over £1·5 millions in the construction and maintenance of works, £171,748 on administration, out of a total expenditure of over £2·5 millions, which included the annual cost of financing the works, interest, and amortisation of debt. Their total loan indebtedness is about £10 millions. About 3000 men are employed by the Harbour Boards.

Out of a total overseas tonnage (1940) of nearly 3,000,000 entering the ports, vessels registered in British countries represented 73 per cent. of the total tonnage entered inwards. The following percentages of the total are given for the principal trading countries, viz.: Australia, 40; United Kingdom, 23; U.S.A., 9; Canada and Dutch East Indies, each about 6; the bulk of the remainder was with islands in the Pacific, Malaya, and Indo-China.

Auckland dealt with more than half the overseas shipping in 1939; Wellington with less than a quarter; Lyttelton and New Plymouth each came next with much smaller tonnage. The total net tonnage of coastal vessels was about half that of the overseas vessels, but they were, on the average, about eight times more in number.

More than sixty years ago Sir John Coode visited New Zealand, where, at the request of the then Premier, he made an examination of nearly every important harbour and of many minor ones. Among the better-known ports at which his designs were accepted and

PORTS OF NEW ZEALAND



WELLINGTON CITY AND HARBOUR
LYTTELTON PORT, DOCK AND BOAT HARBOUR

carried out may be mentioned Dunedin, Greymouth, and Westport.

Auckland Harbour

The Port of Auckland has a total area of 46,700 acres and a water frontage of 198 miles. It is completely sheltered by a chain of islands and by the peninsula at the northern entrance. This entrance — the Rangitoto Channel—has a navigable width of from ½ to 1 mile, with a minimum depth of 31·5ft. at lowest tide. No dredging has been necessary at the entrance or in the channel, but the main wharves have been deepened from 30ft. to 36ft. H.M.S. "Hood" (41,200 tons) entered the harbour, and was easily accommodated at the wharves. Some 260 acres have been reclaimed from the sea.

The largest type of pier, of reinforced concrete, is 1200ft. long, 284ft. wide. The latest type of electric cranes are used. There is a self-propelling floating crane capable of lifting up to 20 tons on high gear and 80 tons on low gear.

The Auckland Harbour Board was legally constituted in 1871. There are fifteen members, eleven of whom are elected every two years by the citizens of Auckland and surrounding boroughs and counties, four by payers of dues, and one nominated by the Dominion Government. Auckland is the only port of call in the Dominion for steamers trading regularly to Vancouver and South Pacific Islands, and the first port of call for many vessels from other countries. The tonnage of overseas shipping entering the port in 1939 was 1,440,092.

Wellington Harbour

Although Captain Cook anchored off the entrance to the harbour in 1773, it was not until 1840 that the first immigrants arrived, to be followed by other ships laden with colonists. Wellington, the capital of New Zealand, was established a year or two later on its present site.

The natural advantage of a land-locked sheltered area of water, over 30 square miles, having depths from 6 to 14 fathoms, with a good anchorage, ensured the development of an important port. Its central position on the waterway between the North and South Islands enabled it to become the chief distributing centre for New Zealand. It is the nearest port in the Dominion and Australia to Panama. The entrance to the harbour exceeds at its narrowest part 3600ft., and has a depth of from 7 to 8 fathoms, with a deep-water channel, 1000ft. wide, entering the harbour. The current never exceeds 2 knots. The tonnage of overseas shipping entering the port in 1939 was 675,341.

Lyttelton Harbour

The port of Christchurch and North Canterbury, Lyttelton, is the port of greatest shipment of frozen lamb, and exports also dairy produce, grain, wool, &c. Extensive cold stores have been erected. The first shipment was made in the sailing ship "Dunedin," fitted with Bell-Coleman machines in 1882. Since then a great industry concerned with refrigeration has been developed.

The entrance to this harbour is one nautical mile wide and is easy of access in all weathers. It has a depth of 7 fathoms at low water just inside, gradually shoaling to 5 fathoms opposite Gollan's Bay, whence a dredged channel, 400ft. wide with 30ft. at low water, leads to the inner harbour enclosed by breakwaters. Vessels drawing 32ft. of water can be navigated into or out of the harbour at any high water.

A reclamation of 72 acres outside the western breakwater was commenced in 1909 and completed seven years later. Grain stores, wool dumping stores, and cold stores for grading and cold storage of dairy produce are provided.

There is a graving dock to accommodate vessels up to 6500 tons and there are large engineering works situated at the port. The tonnage of overseas shipping entering inwards increased from 105,896 in 1937 to 170,138 in 1939.

An important and far-reaching step was taken by the Government in 1940. A Waterfront Control Commission of three persons was formed and Waterfront Controllers and other officers appointed to the various ports. The Commission has very extensive powers, including the employment of labour and the prescription of terms and conditions of such employment, and the rates of remuneration. The purpose of the Commission is to ensure the utmost expedition in the loading, unloading, and storage of cargo.

From 1887 to 1909 the Dominion made annual contributions towards the maintenance of an Imperial Naval Force in Australian and New Zealand waters. The total sum spent, including £1 million per annum (1927–36) towards the naval base at Singapore, was remarkable when the comparatively small population is considered. It was enacted (1913) that whenever Great Britain is engaged in hostilities the naval forces of the Dominion which had been developed should automatically pass under the control and disposition of the Government of Great Britain.

The base of the naval forces is at Auckland. The repair yard is known as "H.M. Dockyard, Devonport." Full use of the machinery and of Calliope Dock is granted by the Auckland Harbour Board. New Zealanders serve as officers in the executive, engineering, and accountant branches, proceeding to England for training in the Royal Navy, the cadets (E) for three years. Recruiting of New Zealand boys and young men is open for all branches of the Service, including engine-room artificers, stokers, electrical and ordnance artificers, &c.

In the 1914–18 war about 100,000 men from the Dominion served overseas. The troops provided for foreign service represented 40 per cent. of the male population between the ages of twenty and forty-five years. It is not possible to publish details of the great efforts made in the present war, but the world knows of the fine reputation won by New Zealand soldiers and airmen serving overseas.

The dangers connected with the Pacific war included the sinking of a number of vessels by enemy raiders, and the possibility of invasion. There never has been any hesitation, but always great eagerness, to dispose of the forces and the resources of the Dominion as desired by the Imperial Government. The young Dominion has produced eminent scientists; the people have shown, in the 103 years that have passed since it was included in the British Empire, great enterprise, vigour, and abiding loyalty to the mother country. We can be confident that, with the inevitable increase in rapid transport in the Pacific, and the extended utilisation of the natural resources of the Dominion, there will be increased prosperity and continuous immigration of Anglo-Saxons into a land that possesses so many attractions.

Forestry

There has been a notable reduction in the area of indigenous forests, owing to colonisation, but the importance of preserving existing forests and of afforestation is fully realised. A Minister of the Crown holds office as Commissioner of State Forests. Central management and control of the service is exercised by the Director of Forestry, with the head office at Wellington. There are seven conservancies, each under the control of a Conservator of Forests.

Auckland City, North Island

The aggregate area of about 8¾ million acres of forest land, controlled by the State, is 63 per cent. of the total forest area and 13·2 per cent. of the total area of the Dominion. The policy is to conserve the indigenous forests for the two-fold purpose of counter-erosion and sustained timber production and expansion of exotic forests for creating a supplementary timber supply. Encouragement is given to commercial afforestation.

As the current timber demands are depleting the virgin indigenous forests at the rate of over 25,000 acres annually, large forests of exotic trees have been established in recent years. The consumption of pulp and paper products has increased, and will almost certainly continue to increase, to supply raw materials for the cheaper products that may become available from the exotic forests. Research work, covering the scientific utilisation of the entire range of wood products, from fuel to cellulose derivatives, is being carried out. In twenty years (1919–39) the annual cut of rough-sawn exotic timber increased from 4 million ft.b.m. to over 46¾ million ft.b.m.

A modern type of log-gang sawmill, to operate in the extensive exotic forests in the

locality, recently installed, has proved to be most successful. Associated with the mill are four kilns for the artificial drying of timber, a box-making plant for the production of boxes, crates, and other wood products; also a creosoting plant for the protection of fencing posts, telegraph poles, &c.

The research work of the State Forest Service includes the study of decay-causing organisms and wood-destroying insects. Advice is given concerning the intelligent use of preservatives; there is routine testing of different types of any which show promise of general commercial application.

The necessity for conserving petrol supplies has caused the service to expedite the production of charcoal from a wide variety of indigenous and exotic timbers. There have been long investigations into the use of charcoal gas producers for both vehicular and stationary engines.

Forest fire control has involved the formation of access roads, tool caches, communication systems by telephones and radio. Fire look-out stations, patrols covering areas of particular danger, and mobile fire-fighting equipment are used. Aeroplanes have proved useful for directing fire-fighting work.

Fire hazard prediction instruments measure relative humidity and relative dryness of forest fuels. These factors are co-ordinated with the wind velocity, rainfall deficiency, and air temperature.

During recent years there has been a considerable increase in the output of timber—in 1936–39 about 293 million units (1 ft.b.m. is a unit of 12in. by 12in. by 1in.) to nearly 336 million units in 1939–40. In the latter period there were 461 sawmills employng 8487 persons.

Thirty-two companies are engaged in afforestation operations, with a capital of nearly £7¾ million in 1940. They own 367,741 acres of land, valued at £14 4s. 3d. an acre. The volume of timber exported was about 30 per cent. more than that imported in 1940; the imports consisting mostly of oak, Australian hardwoods, and Oregon pine.

Technical Education

There were twenty-one technical schools in 1940, the majority of the students taking industrial or commercial courses. There were also 138 centres where technical classes for part-time day and evening students were attending. Technological examinations are conducted on behalf of the City and Guilds of London Institute.

The University consists of four University Colleges, each of which, in addition to providing the usual university courses, specialises in certain directions. At Otago there is a school of mining and metallurgical engineering; Canterbury has a school of engineering (mechanical, electrical, and civil); Auckland has a school of architecture and a school of engineering up to and including the second professional examination; Victoria University College specialises in law. There are also two agricultural colleges attached to the university. The scholarships awarded to graduates include those under the Rhodes Foundation, the 1851 Exhibition Scholarship, and the Engineering Travelling Scholarship.

The Imperial Sentiment

A survey of the engineering and economic development of New Zealand would not be complete without some reference to the Imperial sentiment that has dominated the Dominion throughout its history. That sentiment has affected shipping and tariff policies and the trading facilities given to nationals of countries outside the British Empire. It has been of great value to engineering firms in Britain.

More than any other part of the Empire, New Zealand has thought and legislated Imperially. To many of her leaders Imperial affairs have been of greater importance than local considerations. It is true that at times the attitude of New Zealand statesmen was in conflict with policies of the Colonial Office, as, for example, when they demanded annexation of certain areas in the Pacific and the offer of troops in Samoa in 1899. It would have been of great advantage to the Empire to-day if the New Zealand recommendations had been adopted.

The policy of increasing Imperial solidarity is a legacy of the first colonists. They left their homes voluntarily, but with the firm determination to create a new Britain overseas. The Imperial sentiment became more emphatic as the development of the country increased exports; a strong Navy was obviously imperative to protect the long sea lanes to Britain, the chief market for New Zealand produce. The loyalty to the Crown as the symbol of Imperial unity is emphasised; patriotic speakers do not use expressions similar to those heard in other Dominions, such as "Australia for the Australians" or "Canadian Nationalism." They talk of the British Empire—not of the British Commonwealth.

Nearly a century ago the Governor, Sir George Grey, suggested the federation of the Pacific islands under the leadership of New Zealand, as an integral part of the British Empire. That fine outlook was always in the minds of the New Zealand statesmen who inherited it, but the Colonial Office would not agree with the view that the activity of other Powers in the Pacific was hostile to the Empire. An appeasement policy was never popular with members of the Empire in the Antipodes. New Zealand played a prominent part in combating the centrifugal tendencies which, during critical periods in the nineteenth century, seemed to be hastening the dissolution of the British Empire.

In no part of the Empire has the mother-complex been more pronounced than in New Zealand, from the first days of colonisation onwards. There is a considerable amount of literature concerning the history of New Zealand, and throughout all the records there can be traced that determination, inherited from the earliest colonists and developed by all the leading statesmen, that New Zealand shall be a new Britain overseas and that the British Empire must retain powerful defence forces to protect its widely scattered areas and the oceans. Never at any other time than now in the history of the Empire have the British people had more reason to be grateful for the unswerving loyalty to the Crown of New Zealand.

(To be continued)

Alternative Materials and Methods of Construction of Buildings

THE last of the conferences arranged in connection with the Practical Planning Exhibition organised by the Institutions of Civil and Municipal and County Engineers in London was held on Wednesday, October 27th. The subject for discussion on this occasion was "Alternative Materials and Methods of Construction of Buildings."

Lord Portal, Minister of Works, emphasised how his Ministry was aiming at an improved technique in building, and for that purpose had a close collaboration with the Department of Scientific and Industrial Research with the object of being prepared with a post-war building programme. The Study Committees which his predecessor, Lord Reith, brought into being, had continued their work and their reports were expected before the end of the year. Special mention was also made of the Codes of Practice Committee of the Ministry, under the chairmanship of Sir Clement Hindley. The Ministry had also started an experimental building control to co-ordinate all the views and ideas that had been and were being put forward. Already experimental work was being carried out as a result of that co-ordination, and he mentioned steel houses, prefabricated plumbing, special insulation and soundproofing. Experimental houses in various materials were also being experimented with at the Building Research Station in collaboration with the Ministry, and, generally speaking, quite a number of new ideas were being investigated in that way. There was, however, no virtue in alternative methods or materials unless they were definite improvements on the old. Lord Portal did not think there should be any shortage of materials after the war, and said the post-war programme was being proceeded with on that basis. He emphasised that the control of many materials now being used wholely for war purposes would not exist after the war, and expressed the view that the only control that should exist in the post-war period was where a material was in short supply. At the same time, he stated quite plainly that there should be no shortage of materials and, from that point of view, there was no justification in believing that alternatives were necessary because normal materials would not be available. That, however, did not mean that every effort should not be made to improve existing materials and find new methods of application.

Continuing, Lord Portal said that one of the most urgent needs was a reduction in building costs and to assist to that end, the Ministry had set up a Costings Section, which was doing valuable work. The success of any industry depended upon its costing system, and there would be certain things after the war which undoubtedly would not be the same as they were before. Wages had gone up some 30 per cent. and, in his view, they would remain up. Therefore new methods would have to be devised to offset the higher cost of wages and materials. It would be found that, in order to keep costs relative, there would have to be a speeding-up in various ways and one of them was to get materials from areas which would save considerably in transport.

As regards alternative materials and methods, Mr. E. Minors expressed the view that we should go carefully before abandoning many of the traditional forms of building material which, over centuries, had proved so satisfactory. He complained that whilst at the present time many local authorities were anxious to make a start with a building programme, they were being held up through lack of information from the Government on matters concerning finance and other

details. There was, however, need for prompt action, otherwise we should find the same conditions prevailing after this war as existed after the last one. In his own case it was fifteen months after the last war Armistice was signed before the first contract for houses could be let, and it was nearly two years before the first house was occupied.

Mr. R. T. James, M. Inst. C.E., suggested that in post-war building construction, because of our great iron production and the men employed in that industry, there should be, and might need to be, a greater and immediate use of steel and cast iron. Nevertheless, a careful study should be made of the older forms of building construction for such permanent and intimate things as new houses. A steady and informed judgment was necessary, which, however, should not be restrictive or obstructive to the use of new materials and methods. There were modern but well-tried materials and methods of building which could be used with confidence. For example, the reinforced concrete raft and beam, properly designed, could be used more to save the mass excavation and concrete and brickwork put into foundations.

Mr. G. G. Wornum, F.R.I.B.A., said that many suggestions that had been made for building construction in the post-war period were not practical to-day, but the direction of thought and the goal to be reached were forcibly apparent. It might be possible to get the weight of a six-roomed house down from 125 tons to 16 tons or less by new materials and methods, but their employment would mean a definitely new approach to the æsthetics of building, and no attempt could be made with any success to emulate period or traditional styles by such means. But perhaps that need not cause anxiety when one considered the attitude of the younger generation towards such matters. Alternative building materials which might come into use after the war were aluminium and light metal alloys generally, strip steel extruded and pressed, and much greater use of welding for jointing. Cast iron had undergone considerable development in recent years, particularly in regard to stoved finishings. Plywood, with resin bonding, promised to become a most important material. Glass, too, had made great developments, particularly in the direction of armoured glass and insulating glass. Incidentally, he mentioned that a method of welding aluminium to glass had been found. Plastics were covering a wide field and methods were in use in America for welding plastics to metal and to themselves. Laminated plastics would no doubt have a great future for general covering purposes on all surfaces taking hard wear. All kinds of developments had taken place in the use of thermal insulation, which made for light construction in buildings and produced actually better results than traditional materials, though there was much yet to be done to produce sound insulation by light-weight methods at economic cost. Alternative materials, however, could only serve for short-term building. To-day, the population of England and Wales was three times what it was 100 years ago, and, he suggested, we now lived in the age of the "mass" man. The mass man required to be housed to the extent of 4,000,000 new homes, it was said. How could that be done in ten years and while our damaged cities with out-of-date planning were reconstructed at the same time? Building production by short-term policy methods with alternative materials seemed to be the only hope of such a programme being fulfilled, such extra production being mainly handed over to industry for the mass production of components. By short-term policy, however, he did not mean that at the end of twenty years the whole structure might be valueless, but that parts, particularly the outer skin exposed to the weather, might be replaced, and at no very great expense, if consisting of standardised components. For long-term policy he suggested that the more traditional materials and methods would have to be employed, although no attempt should be made to copy period styles owing to the need for greater flexibility as civilisation developed.

Mr. Evans (Director, Building Research Station) discussed alternative materials in the construction of domestic dwellings. He mentioned the possibilities of light frame construction, sound insulation, fire protection, thermal insulation, vermin infestation, strength and stability and damp penetration, all of which, he emphasised, must be carefully considered in using new materials and methods. The whole problem had been under consideration in recent months and it was hoped that before long suggestions for standards of performance would be generally available. There were many reasons why that should be done. It would permit of improvements in standards rather than reproduction of the old, and it would help ensure that the alternative forms adopted would give adequate performance without being wasteful in materials and labour. The designer would know what he had to aim at, the builder what he had to build for, and the manufacturer of materials would be better able to guide his production into the right channels. Thus they would all be better able to give that full co-operation with the Government and other authorities concerned, which was so essential in carrying through the post-war programme.

Mr. Wilson urged that alternative materials generally should not be advocated for every possible purpose, for if that were done then a great disservice would be done to the particular material.

Dr. R. Bradbury, an architect, said that as a large number of new houses would be required immediately after the war, we must view the problem realistically. We should not be in the position to adopt those other methods of construction that had been referred to, although no doubt they would come in time. Therefore the great proportion of new houses immediately after the war would have to be of the traditional construction, and it was to be hoped that intensive research into the newer materials and methods would take place whilst the first houses were being constructed. He believed it would be a long time before the British public accepted the more fragile forms of construction that had been referred to; the British nation liked things solid and good.

German Aero-Engine Pistons

WE have received from the Ministry of Aircraft Production a summarised report of some metallurgical investigations of light alloy pistons from German aircraft. The investigations were conducted by the metallography department of the research laboratories of High Duty Alloys, Ltd., under the direction of Dr. C. Wilson, Ph.D.

The investigations were directed principally to determining the types of alloys in use and the general standard of quality adopted, and to obtaining information relating to the methods of manufacture employed. The mechanical properties of each component have been determined, and the test pieces were selected in relation to the directions of grain flow and the service to which the components have been subjected. Heat treatment and general quality have been assessed by metallographic methods.

FIG. 1—PISTON OF MERCEDES-BENZ D B 601 N ENGINE

Seven pistons, representing four engine types, have been examined, and an example of each type is illustrated in Figs. 1 to 4 inclusive. The pistons were similar in that each had been produced to close internal limits, with the object of reducing machining time. In each case crown reinforcement had been obtained from the ribs, formed in the dies. The pistons had been utilised with very little internal machining, and the finish produced by the forming dies was evidently considered to be satisfactory for duty under conditions of severe stress and high temperature.

With the exception of the piston from the Bramo-Fafnir engine, the material employed was of the eutectic silicon-aluminium type, containing additions of copper, nickel, and magnesium. The results of chemical analyses are given in Table I.

FIG. 2—PISTON OF B.M.W. 801-A1 ENGINE

The mechanical tests were carried out with tensometer test pieces obtained at selected positions. The test positions enumerated in Table II were selected to determine the effect of the operating temperatures on the properties of the material. The test results obtained at the base of the skirt or at the lower portion of the gudgeon pin boss usually provide a close indication of the original properties, and by comparison the gradual deterioration

to the centre of the crown, normally the hottest zone of the pistons, can be assessed.

The results quoted in Table III represent the average of at least two tests. A further average of the results at position 4 indicates that the probable strength of the silicon-aluminium alloy was of the order of 21 tons per square inch ultimate tensile strength and with an elongation value of 3 per cent.

Considerable softening of the material takes

TABLE I

Engine type.	Cu, %	Ni, %	Mg, %	Fe, %	Si, %	Ti, %	Mn, %
B.M.W. 132 engine	0·88	0·91	1·08	0·53	12·04	0·09	0·04
B.M.W. 801-A1 engine	1·08	0·99	1·15	0·56	11·42	0·09	0·02
Mercedes-Benz DB601N engine	1·05	0·95	1·17	0·42	11·4	0·09	0·02
Mercedes-Benz DB601 engine	1·09	1·15	1·06	0·71	11·65	0·12	0·02
Jumo 211 F1 engine	0·97	1·05	1·30	0·42	11·4	0·03	0·04
Jumo 211 A1 engine	1·02	0·93	1·16	0·43	11·7	0·08	0·06
Bramo-Fafnir 323-P1 engine	3·54	1·75	1·37	0·36	0·07	0·01	—

place at the crown of a piston during service, and when hardness tests are carried out on a cross section a marked hardness gradient between the crown and the skirt is observed. It is generally found that at the base of the skirt the material suffers only a slight deterioration in hardness and from this value an indication of the original hardness of the piston can be obtained. Values within the range 90–120 Brinell have been provided by the samples in

TABLE II.—*Position of Test Pieces*

Position 1 ...	Centre of crown
Position 2 ...	Gudgeon pin boss, normal to crown
Position 3 ...	Gudgeon pin boss, parallel with crown
Position 4 ...	Lower skirt or lower gudgeon pin boss

the silicon-aluminium alloys. By relating the hardness values obtained by a careful survey on a cross section of a piston with the mechanical test results and the general structure, it is possible to obtain an indication of the operating temperatures. The isothermals, Fig. 5, have been obtained in this way.

The grain flow, as observed in etched sections prepared on a plane normal to the crown and

TABLE III.—*Mechanical Test Results*

Engine type.	Position	Yield point, tons per sq. inch.	Ultimate tensile strength, tons per sq. inch.	Elongation per cent on 4/A.
B.M.W. 132 engine	1	10·4	14·1	7·0
	4	17·8	20·5	3·5
B.M.W. 801-A1 engine	1	11·5	15·2	5·5
	2	16·3	19·0	3·0
Mercedes-Benz DB601N engine	1	8·9	12·8	9·0
	2	10·9	14·1	4·0
	3	12·6	15·5	3·5
	4	16·0	19·5	2·0
Mercedes-Benz DB601 engine	1	13·8	16·1	3·5
	3	16·9	18·3	2·8
Jumo 211 A1 engine	1	10·1	13·3	6·0
	3	—	18·5	2·5
	4	23·0	24·2	2·5
Jumo 211 F1 engine	1	11·0	13·7	3·5
	2	17·5	18·6	2·5
	3	15·3	17·3	3·5
	4	18·3	19·9	3·5
Bramo-Fafnir 323-P1 engines	1	13·0	19·4	11·7
	3	15·0	19·7	6·8
	4	23·5	26·7	8·0

through the gudgeon pin bosses, showed practically identical features in all cases. At the centre of the crown the flow lines were practically parallel with the external surface, but at the internal surface the metal in contact with the die had remained practically stationary. At the sides of the piston the grain flow followed a direction practically normal to the crown, and above the gudgeon pin bosses the flow lines emerged at an acute angle to the surface of the crown. The grain flow in the lower portion of the gudgeon pin bosses was practically parallel with the gudgeon pin axis.

In order to investigate the method of manufacture, the microstructure in planes normal and parallel with the crown has been examined. The methods of manufacture adopted for the four types of piston had evidently been very similar. In the specimens prepared, parallel with the crown surface, the original eutectic network remained largely undisturbed, whereas at right angles to this direction the micro-

FIG. 3—PISTON OF BRAMO-FAFNIR 323-P1 ENGINE

structure showed fairly well-defined flow of the constituent particles. The eutectic areas remained, however, and merely showed elongation in the direction of flow. The majority of the pistons had been manufactured in the eutectic silicon-aluminium alloy. In the samples

FIG. 4—PISTON OF JUMO 211 F1 ENGINE

exampled, however, the fine modified structure normally associated with this alloy was not seen and the influence of the modifying reaction seemed to have been largely dissipated prior to solidification. The Bramo-Fafnir piston showed fine particle size.

The general features observed in the samples

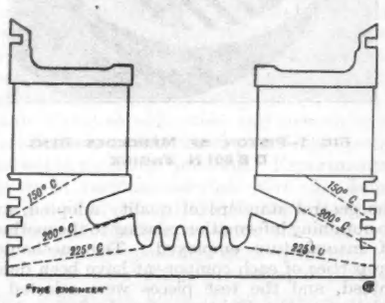


FIG. 5—ISOTHERMALS

examined are those of pistons produced by pressing in dies, from extruded blanks, the close internal limits to which these pistons have been manufactured being typical of the press forging method of production. The appearance of the microstructure is regarded as indicative of extruded stock, although the degree of reduction in extrusion had not been great. It would appear that the Germans have adopted a standard manufacturing procedure, and have practically standardised an alloy to be used for pistons. The procedure adopted constitutes a simple and economical mass production method, and provision for the variation in engine conditions seems to be made by ribs on the underside of the crown and by adjustment of the machined contours of the crown surface.

The pistons would be regarded as of good general quality, although the rather inferior microstructure of the B.M.W., Mercedes-Benz, and Jumo pistons would not be expected to be accompanied by the best properties. It seems that the German manufacturers do not consider modification of the eutectic silicon-aluminium alloy to be important, and evidently permit coarser particle size than is normally considered to be acceptable.

Profits on Warship Construction*

YOUR Committee have inquired into the circumstances under which very high rates of profit on cost were yielded by fixed-price contracts for the hull and machinery of warships ordered from 1936 to 1939. These profits were disclosed by a cost investigation initiated by the Board of Admiralty in 1941, on the recommendation of the Director of Contracts, as a guide to future price settlements. This investigation covered thirty-two warships, comprising a battleship, an aircraft carrier, cruisers, destroyers, submarines, and smaller craft, and representing about a quarter of the ships ordered during the period, the total cost of which at contract prices, including profit, was about £90,000,000.

The following results were disclosed :—

Profit on cost (hull and machinery).	Number of cases.
Less than 10 per cent.	4
Between 10 and 20 per cent.	5
Between 20 and 30 per cent.	9
Between 30 and 40 per cent.	7
Between 40 and 50 per cent.	2
Between 50 and 60 per cent.	1
Between 60 and 70 per cent.	1
Between 70 and 80 per cent.	2
Over 80 per cent.	1

No evidence was available as to the rate of profit earned on the capital employed nor did the investigation extend to sub-contractors' costs, which comprised 21 per cent. of the total costs investigated.

The shipbuilders concerned represented that the ships selected by the Admiralty for the investigation did not give a true picture of the profits being made on warships generally and, in support of this contention, furnished statements of the costs of twenty-five ships built somewhat later, showing rates of profits on cost in seven cases less than 10 per cent., in seventeen between 10 and 20 per cent., and in one case (a battleship) over 22 per cent. Although the Admiralty's investigation was carried out only as a guide to costs of vessels ordered at a later date, the builders, with the exception of one firm, the profits of which were stated to be insufficient, accepted an Admiralty proposal that they should waive all claims for extras on certain ships to the number of 128, the Admiralty for their part waiving claims for rebates. The net advantage of this to the State is £2,250,000.

Commenting on the foregoing facts, the Comptroller and Auditor-General pointed out that the tenders for the ships in question were presumably based upon the experience of periods before knowledge had been obtained of the effect on costs of the continuity and size of orders under the rearmament programme. He remarked that the results of the Admiralty investigations suggest that, under the conditions prevailing during the construction of the vessels in question, sufficient safeguards against undue prices were not provided by the tenders obtained for a number of ships, or by the recommendations as to fairness of tendered

* From a Report from the Committee of Public Accounts, October, 1943.

prices made by the technical departments concerned in the light of previous experience.

In evidence before your Committee, the representatives of the Admiralty and the Treasury expressed agreement with these conclusions. The former explained that the acceptance of the fixed prices quoted by the firms was primarily based upon recommendations by the various technical departments of the Admiralty that the prices were fair and reasonable. It was stated that these recommendations were made on the basis of the prices of warships previously constructed, corrected for modifications in design and for estimated increases in rates of wages, costs of materials, and other factors. The Admiralty had also before them the cost of ships built in H.M. dockyards and in the matter of the contracts for the battleships they were assisted by a Contracts Advisory Committee composed of business men, including a chartered accountant. It appears that, after considering a report submitted by the Director of Naval Construction and the Engineer-in-Chief, the Advisory Committee recommended the acceptance of the prices tendered for the battleships as fair and reasonable, and it was not considered necessary to take advantage of the facilities which the firms had undertaken to give for the examination of their estimates of cost in detail.

Particulars of the cases investigated by the Admiralty were furnished confidentially to your Committee for their examination. In their opinion the outcome of the contracts covered by the cost investigations shows clearly that the Admiralty's methods of safeguarding themselves against prices yielding excessive rates of profit failed signally to achieve their object.

The check assumed to be afforded by comparison with the cost of constructing warships in H.M. dockyards appears to have covered only two classes of ships, cruisers, and submarines. It was disclosed in evidence that the cost of the dockyard-built cruisers and submarines during the period under inquiry actually exceeded the prices (including profit) of comparable contract-built ships, but a statement later sent to your Committee by the Admiralty shows that, during an earlier period of some years, the cost of dockyard-built hulls of cruisers were somewhat less than the prices paid for contract-built hulls of similar ships. It was also explained in evidence that the dockyards are primarily repair yards, and that in the years just before the war they were very fully occupied with modernisation and later with conversion and repair work, so that it was not possible to get a clear run on the job of constructing warships in the period in question. This explanation has since been supported by statements submitted by the Admiralty giving assessments of the extra costs of certain dockyard-built cruisers and submarines due to interruption, retardation, and other causes.

While the explanation appears to be well-founded, it is clear that the assurances given by the Admiralty to the Public Accounts Committee in 1938 and again in 1940 that their dockyard experience gave a good indication of what shipbuilding prices ought to be had already lost a great part of their validity at the time they were given.

It was contended by the Director of Naval Construction that the estimates of cost compiled by the technical departments of the Admiralty were in themselves sound, and that it was only in forming their own opinion as to the anticipated increases in material and labour costs that a substantial error of judgment was made. It was admitted, however, that, notwithstanding the steady flow of orders with which the private yards were being filled, no reduction was made in the percentage allowed for overhead expenditure. Your Committee are forced by the evidence to the conclusion that the knowledge possessed by the technical departments of shipbuilding costs in the private yards has proved gravely inadequate. In recent years the Public Accounts Committee have on several occasions had their attention drawn to a number of cases in which prices certified by these departments to be fair and reasonable have been shown by cost investigations to be excessive. In the light of the present disclosures your Committee are of opinion that the methods and functions of the technical departments of the Admiralty in relation to the determination of contract prices call for drastic review.

Meanwhile your Committee are glad to record that the seriousness of the position disclosed by the cost investigation is fully recognised by the Admiralty, and that certain measures have already been taken to safeguard the future. They note that tenders are to be submitted in future divided into the heads of direct charges, overheads, and disbursements, that the practice of costing will be continued in specimen cases and that use will be made of the Admiralty Principal Accountant's figures of establishment charges of the various firms. For certain types of naval auxiliary vessels the procedure has been adopted of obtaining statements of the costs of construction for groups of ships from the builders concerned and of paying for each ship at the average cost of the group plus a lump sum for profit, on the understanding that the Admiralty will be supplied later with an audited overall group profit certificate for all ships coming within each settlement and have the right to make an independent cost investigation. Your Committee further note that neither the Treasury nor the Admiralty regard the proper control of future prices for warship construction as being fully met by the measures already taken, but agree that the matter is one of exceptional difficulty requiring continued examination with a view to further improvement in method. Your Committee fully concur with these views.

Invention and Its Relation to Industry*

By E. W. MOSS (Member)

In a paper on "The Evolution of Invention," read by Mr. H. W. Dickinson before the Institution of Mechanical Engineers in 1934, he suggested that "too much stress should not be laid upon the acquisition of vast knowledge by the inventor, as many inventions have had their inception in ignorance of what had already been accomplished in their fields." This is in contradistinction to suggestions made at other times by leaders in industry who have advanced the theory that invention will be most efficient if the potential inventor who sets out to solve a certain problem has before him a full knowledge of all that has been done heretofore in connection with his problem. It must be borne in mind that an inventor in these circumstances may be led away from a successful solution of the problem by a knowledge of what others have proposed, because it is difficult to ascertain or realise why a particular line of attack has failed. It will often be better for the potential inventor to follow a line entirely suggested by himself. He may, however, after he has proceeded a certain way, find it useful then to ascertain whether others have followed that line and what success they have achieved. It is difficult and, indeed, impossible to lay down rules for the production of inventions. It depends so much on the individual inventor. When he sets about solving a particular problem he will have to deal with all the subsidiary problems and difficulties as they arise during his work.

An invention may be produced on the instant by the union of genius and experience, or it may be the result of laborious research.

* * * *

In the past there has been an instinctive objection to new ideas which might result in the loss of work to the workpeople or because they might upset business as it existed at the time.

Indeed, there has been some foundation for this objection, because the introduction of some inventions has for a time caused unemployment. But history has shown that eventually the cheapening of articles resulting from those inventions has made their use much more general, so that in fact a larger employment has been brought about.

Social legislation will no doubt provide the means to overcome such difficulties as may be experienced in transition periods, so that the worker may have no fear of any immediate and temporary difficulty produced by the introduction of an invention and the full benefit from it may be subsequently attained. Invention can only tend to reduce the price of goods and provide goods which improve the amenities and enjoyment of the people.

* * * *

It is often said by the uninstructed that invention has been a retrograde step in human advance and that had there been no invention there would have been no wars or anyway they would not have been so terrible. Such arguments are unsound. The misuse of inventions, as it has been called, depends on the education of the human race. It is for others to see that inventions are rightly applied and it is not the duty of the inventor or the chemist or engineer to do that. As Sir Alfred Ewing said in his James Forrest Lecture in 1928, "In our diligent cultivation of these arts we engineers have perhaps forgotten that progress in them has far outstripped the ethical progress of the race."

* * * *

There are some who consider that all monopolies should be abolished. Results show that the limited monopolies now granted by the State for inventions or new manners of manufacture act as an incentive to the production of new inventions and also to the development of inventions already made which are of considerable value to the community. For it must be borne in mind that while an invention may be produced in the mind of an inventor and even committed to paper, it will generally be valueless to the community until it has been developed practically, *i.e.*, reduced to a form which can be manufactured and manufactured at a price at which it can be acquired by the largest number of the community desiring it. During such practical development further inventions may well be made. While it is true that investigation and research in science would continue whether there be monopolies for inventions or not, nevertheless it seems amply proved that industrial development is encouraged by the existence of such monopolies.

It is usually considered that articles made under a monopoly are more expensive than other articles, since it is assumed that a royalty has to be paid to someone. That is not nearly always so. Many manufacturers obtain monopolies for inventions in order to keep the trade to themselves and be in a position to supply exclusively an article with advantages over others, but which must be supplied at a competitive price.

* * * *

A great deal of thought has been given to standardisation in industry. While standardisation for the purpose of providing interchangeability can be of great value, standardisation of construction or too much standardisation of detail can be dangerous, in that it may tend to stultify invention and progress. Standardisation of size for a particular shape of a part must be distinguished from standardisation of shape. While alteration of size may permit alteration of construction, it is, perhaps more likely, that alteration of shape may permit alteration of construction to greater extent. There is a school of thought which considers that the use of standardised articles only should be permitted. If such were the case, invention and progress would be hampered, for no invention involving other than a standardised article would have chance of success.

If size or shape is standardised it may have the effect of discouraging inventions which cannot be produced in the standardised size or shape. Thus it may be that standardisation of the spacing and size of fixing holes of a meter will prevent new inventions and advances in meters because such inventions and advances can only be provided if other than standardised sizes are available. On the other hand, it may be that the benefits from standardisation will outweigh the benefits of such possible inventions and advances. Very careful thought should therefore be exercised before a decision is made to standardise an article or a part.

* From the Chairman's Address to the Measurements Section, Institution of Electrical Engineers, October 22nd.

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ENGINEERS AND NATIONAL PLANNING

AT a time when the Institution of Civil Engineers is giving particular attention to post-war planning, it is apposite that its President, Dr. Anderson, in his Address, an abstract of which we print on another page, should deal with that subject. But Dr. Anderson does more than discuss only planning and the part that engineers should play in it. He makes clear also his opinion that engineers, upon whose past work our modern civilisation has been built and upon whose future labours it must depend for its further development, ought to take a greater part in the administration of the country and, by implication, of the Empire.

In a number of articles, published in our pages during the last few years, dealing with the work of engineers in China, Malaya, and the East, Dr. Middleton Smith has drawn attention again and again to the relatively low status to which engineers in the Government service of our Colonies are relegated. Dr. Anderson, in his Address, shows that in our home Civil Service the rule holds good that the higher posts are not open to engineers, and that, with the sole exception of the Post Office, they cannot, at least in theory, make a direct approach to the Minister or even to the head of the Department. It is difficult to account for the low opinion that is apparently held of the administrative abilities of engineers. The satisfactory management of engineering works with all the human problems therein involved, and even more the contented functioning of those great temporary towns necessary where large-scale civil engineering works have to be carried out in sparsely inhabited districts, void of amenities, under the control of engineers, is surely proof that engineering training and experience is no impediment to the acquisition of high administrative abilities. The neglect, we can but assume, is as much the fault of engineers themselves as of conservatism in the selection and promotion of civil servants with a different training. Engineers choose for themselves a career that is so absorbingly interesting in itself that they are inclined, we think, to give consideration to its problems alone and disregard those of wider interest with which laymen are concerned. But in the last thirty years two world-wide wars, following closely the one upon the other, have stressed the bitter paradox that in war engineers will be expected to provide the tools that can and will be used for the destruction of those peacetime works in which they took such pride; and have forced a growing number of engineers to the conclusion that, willy-nilly, they should take more interest in the use the community makes of the great powers they can provide for good or evil. Thus, we think, Dr. Anderson will find many to agree with him that a system that relegates engineers to junior positions in a world vitally dependent upon their works needs reformation.

Dr. Anderson suggests, amongst other means of bringing about the desired reformation, that certain departments of the State, notably the War Departments and the Ministry of Town and Country Planning, should, on account of the predominating importance of engineering to them, be placed in the control of engineers or scientists. But though we may hesitate to support the President in a proposal that will seem to many to arrogate to engineers and scientists a skill and knowledge of affairs not necessarily theirs alone, we still consider that engineers, were they so minded, could with advantage to the State play a larger part in the control of such departments than they are at present permitted to do and that there should not be, as at present, any automatic bar against their appointment to the highest positions within them. Those very qualities that have caused the engineer so successfully to direct the powers of Nature "for the use and convenience of man" could, we believe, prove of the utmost value to a legislator or administrator faced with the need for national planning on a scale vaster than ever before contemplated, and should surely be available to him at the highest and most influential level.

Duplication of Effort

WHILE it is most encouraging when viewed from one angle to learn that the Prime Minister is satisfied that we have reached the stage when the maximum number of the community are engaged in the war effort, it does not necessarily follow that there are no square pegs in round holes, or that there is no unessential work being performed, or that there is no duplication of effort. What more pathetic picture can be conceived in wartime than that of workers feverishly concentrating on something that really does not matter? Admittedly, this is a state of affairs that can be more readily detected and set right than is possible in the case of two people or institutions doing the same work, even if from different standpoints. It is perhaps the Englishman's prerogative to seek to blame the Government, and to suggest that it is time something was done! Such people would immediately affirm that there is considerable overlapping of responsibility between different Government Departments, and they may suggest as a good instance the respective functions of the Ministry of Supply and the Ministry of Production. It is readily conceded that the last-named Ministry would have had a much easier passage had it come into existence at the beginning of hostilities, or, better still, in anticipation of such hostilities, for it could then have co-ordinated all production and allocated facilities to the different Services with a full knowledge of the whole requirements of the War Cabinet. In spite of its birth "out of season," we believe there has been a genuine and fairly successful endeavour on the part of the different supply departments to co-operate as fully as possible with the newer Ministry, and to use their engineers and technicians to furnish information and so avoid the very overlap that all deplore. But let us, as engineers, be sure that our own house is in order before we succumb to the temptation to arraign the Government.

There has been a growing tendency in many of the larger engineering enterprises to work on functional lines which throw open the door for many of the employees to appear to be serving more than one master, whereas the biblical dictum that "No servant can serve two masters" is as true now as it was nineteen centuries ago. The question arises as to whether the lines of demarcation have ever been clearly defined, and, if so, whether adequate steps have been taken to ensure that everyone in the organisation clearly understands what his or her duties are. Perhaps a specific example might explain what is in mind. It is decided that all the records should be centralised in one department and kept in the manner that has been approved as most suitable; yet how many managing directors would be bold enough to affirm categorically that none of his production managers built up their own personal records? He may even himself sometimes be guilty of using a shop record rather than the official, and wonder afterwards how he has managed to make conflicting statements. We may have cited an unfortunate instance in that the very term "production returns" is anathema to many

on account of the apparently insatiable appetite of the Government for multitudinous returns. This in itself, however, raises another suggestion which is the extent to which the official records of each concern could be so adjusted as readily to fall into line with the returns rendered to the Government. This would certainly obviate a good deal of duplication, but at the same time we would entreat each department that seeks information to make its requests as simple as possible, and to refrain from asking for any extraneous matter. Is there any duplication of effort in the engineering factory itself? Too often we should have to give an answer in the affirmative. By instancing two specific cases, the moral may be inferred. A much-harassed turner was engaged on three distinct jobs, each of which was urgently required for some experiments that were in hand, and while the shop foreman was personally interested in one, the works manager favoured another, while, as luck would have it, the general manager was anxious for the completion of the third. Things got to such a pass that the mechanic became so nervous that he always kept a weather eye open, and actually substituted one job for another in his lathe, according to the official whom he saw bearing down on him—a truly impossible situation, clearly indicative of the unjustifiable overlap of supervision in the factory in question. The other case presents a brighter picture. The chief foreman of a steel foundry was promoted to the post of works manager, and he at once realised that he knew everyone in the foundry and was keenly interested in all its products. This led him to make a mental resolve not to enter the foundry for the next three months, but to devote all his energies to the other shops that now came under his control, and to let the new chief foreman of the foundry work out his own salvation, the result being that eventually both officials admirably filled their respective spheres.

In the past, unfavourable comment was frequently heard about the multiplication of engineering institutions and the way in which there was a tendency for their functions to overlap. It is noticeable, however, at the present time, that a real effort is being made to recognise clearly defined lines of demarcation and to arrange joint meetings for what might be termed border-line subjects. All such action tends to the elimination of that duplication of effort which should be deprecated, and opens up an avenue of exploration for industry generally. Let no one imagine that we seek in any way to repress the value of individual effort, and the enthusiasm that results from doing a job better than anyone else, but let us also increasingly benefit by the reflection that ultimate success is assured when there is a skilful co-ordination of individual efforts.

Engineers and National Planning*

By DAVID ANDERSON, LL.D., B.Sc.

No. I

BOTH the last war and the present one have been called "engineers' wars," and quite accurately so. More and more, warfare has become a matter of machines hurling death and destruction all around them. Men kill and drown each other from miles away. The destruction of the weaker combatant seems to be due to a matter of fewer inches in the diameter of a gun or of fewer pounds of weight in a bomb. But surely the skill and ingenuity that have been used for purposes of destruction in time of war can be used, and should be used, for purposes of construction and improvement in times of peace, and the whole burden of this address is to that end.

For one reason or another, although the work that is being carried out by modern engineers is even more exacting than in the past, often on a much larger scale, and certainly far more complicated, civil engineers and the heavy responsibilities they carry are largely ignored by the modern layman. It does not seem to be realised that if engineers failed in their work modern life as we know it would break down. Trains would cease to run, roads and bridges would give way, there would not be any water, gas, or electricity in our towns, and disease would spring up. Another disturbing feature is that the services of engineers are apt not to be made use of in the early stages of schemes. It may be that engineers are largely responsible for this state of affairs. They are prone to be reticent and to shun self-advertisement. It is apparently not realised that engineers are planners as well as technicians, and that the success that attends modern engineering work is due not only to technical skill, but also to the very careful study made beforehand of all the conditions and to the sequence of operations that must be followed.

It is high time that the engineer, who has perhaps rashly and blindly created modern life, should now be associated with the control of it and help in directing its future shape. Let all of us refuse to sink into the position of being merely technicians—of which there is a real danger in our absorption in our profession; let us rather take the position of planners and leaders. We shall need to equip ourselves for such a position. That is a difficult problem and will require careful consideration.

Other nations besides ourselves have been conscious that all was not well with them, and have taken steps to a more planned *régime*. From one motive or other, and with various objectives in mind, Soviet Russia, the United States of America, Germany, and Italy have all planned. It is not easy to say to what extent the planning has been directed by engineers, but most certainly the great bulk of the work has been carried out by engineers.

Lack of Planning in Great Britain: How the Nation is Governed

The machinery of government in Great Britain is complex. Under the Crown it is a combination of Parliament, Ministers (formed into a Cabinet), and the Civil Service, all of which act and react on each other. Ministers tend to do and to be what Parliament wants; civil servants to do and to be what Ministers want. The reverse is also the case, particularly in regard to the influence that permanent civil servants exert upon Ministers whose tenure of office is often brief. Nowhere in this structure is there any machinery for planning ahead, or for any change in its working to keep pace with the changes in the world outside it. It is still founded upon the old conception of government as a regulatory policing and taxing mechanism.

(*a*) *Parliament.*—The word "Parliament" means "a talk." Legislation was not at first its primary business, but as our long and varied history shows, "travelling slowly down from precedent to precedent," it has more and more been transformed into a mechanism for the issue of a never-ceasing and increasing series of "Acts of Parliament." Parliament consists of two "Houses," the House of Commons and the House of Lords. The members of the House of Commons are drawn from all classes and from many professions. Very few, however, are engineers.

(*b*) *Ministers.*—Ministers, of whom there are thirty-five in all under war conditions, are selected from members of both Houses of Parliament and have control of the various Departments into which the working and defence of the country are divided. Grouped together, Ministers form the Cabinet. Each Minister is responsible for the policies pursued in his Department.

(*c*) *The Civil Service.*—The Civil Service is divided into three categories, clerical, executive, and administrative. Recruitment is normally by means of competitive examinations planned to tap four different levels of education. Promotion is slow and largely by seniority. Elaborate checks are provided to prevent fraud, political partisanship, and personal advertisement. The total number employed is about 400,000. The upper ranks form an official class of very limited numbers. The total of the Administrative Grade in 1939 was 1300 persons, of whom more than three-quarters were recruited direct by competitive examination at the age of twenty-two to twenty-four, and served a sort of apprenticeship as assistant principals before being given more responsibility. Their education is still predominantly literary. Administrative officers usually spend their whole official careers at headquarters without any experience of responsibility for securing results. Problems are apt to be dealt with solely on paper. Knowledge of science is weak. There is no "staff" or advanced training. The weakness of the Civil Service is due not to incapacity, but largely to an overpowering group of inhibitions. The whole trend is towards jogging along in step with the machine, personal leadership and initiative not being encouraged.

Owing to the various changes that have taken place in modern life, some 10,000 specialists or experts have had to be brought into the machine to deal with technical matters. They do not fit properly into any of the main categories, clerical, executive, and administrative, and in practice are not allowed to ascend to the highest administrative posts. They do not have direct contact with the Minister. If some point arises with which the expert has to deal, he drafts a memorandum addressed to a member of the administrative staff, possibly an Assistant Secretary, perhaps only a Principal. A minute is then prepared, based on the expert's report, for the consideration of a Principal Assistant Secretary, or perhaps even the Permanent Secretary. It should, however, be stated that with our national genius for compromise, the machine is not so rigid in actual working as it would appear on paper. This elasticity gives hope that it

* Institution of Civil Engineers. Presidential Address, November 2nd. Abstract.

should not prove too difficult a matter to introduce changes.

One Government Department—the Post Office—has already abandoned the system of working outlined above, as a result of the Bridgeman Report. This is due partly to the fact that the Post Office is a revenue-earning Department, and partly to the great importance to it of scientific developments in its engineering services. A Board system has been adopted. The Board includes the Postmaster-General, the Assistant Postmaster-General, the Director-General, the Deputy Director-General, the Comptroller and Accountant-General, the Engineer-in-Chief, the Director of Establishments and Personal Director of Telegraphs and Telephones, the Director of Postal Services, and the Public Relations Officer. The Director-General replaces the Permanent Secretary, who is the head of the staff of other Government Departments, but his position is only that of *primus inter pares*. If this system were extended to the other Departments, the expert would come into his own as regards the consideration and formulation of general policy, and the Minister would get his views first-hand. Such a system has close affinities with Local Government Committee practice.

Sir Lawrence Bragg recently suggested that leading scientists might be appointed as advisers to the various Government Departments and give, say, one-third of their time. This seems a useful beginning. Another improvement would result if the entrance examinations were drawn up so as to ensure a larger quota of entrants familiar with the history and methods of science and sympathetic to the scientific outlook. At the top end, technical men should be eligible for administrative posts (and should deliberately qualify for them). The changing form of civilisation demands the recognition of the expert and the impact upon it of his work.

In addition, would it not be possible for civil servants of the various grades to be seconded for duty in the executive and engineering sides of their Departments at an age before they have become hardened by routine? It is easy to imagine the broadening effect on the mind of a fairly senior official in the Admiralty if he had, say, two or three years' service in various branches of the Navy, together with "refresher" courses as he grew older. The leaven of men with this training would spread with the lapse of years as the older type died off.

What about Parliament and Ministers, upon whose policies and thoughts party politics inevitably have such power? Must party politics always hold sway over all the Departments of State? Could not certain of them be deemed to be so essential to the orderly and scientific control of the development of the nation's life as to be beyond the reach of fluctuations due to party politics? If party politics could be disregarded in the administration of the Admiralty, the War Office, the Air Ministry, the Ministries of War Transport, of Works, and of Town and Country Planning, and the Post Office, would it not then be possible for these Departments to be in the charge of men with engineering training or outlook, and for their policies and work to be planned for years ahead and backed by the best scientific brains of the country?

(To be continued)

Letters to the Editor

(We do not hold ourselves responsible for the opinions of our correspondents)

"THIS FREEDOM"

SIR,—Lord Strathspey's letter in your issue of October 22nd makes a most important contribution towards the solution of the problem of how to expand our export trade. By all means let the primary products industries, such as chemicals, steel, cotton, wool, &c., follow the example of the rubber industry, and inspire the federation of all businesses which use the primary product to any appreciable extent in the manufacture of their goods. But may I be permitted to carry Lord Strathspey's suggestion perhaps a thought further?

No longer can British goods mainly rely for expansion of demand on first-class materials and perfection of workmanship. Suitability to the market, suitability of style, and attractive prices are equal essentials. So, too, is complete understanding of trade conditions, competition, and trade customs. The consular services and commercial attachés cannot be expected to have the detailed knowledge required by individual businesses, or to be in a position to finance and staff the obtaining of it.

What is needed is that each federation (and the Rubber Federation might well make an immediate start) form an Export Market Research Organisation to discover and set out as simply as is intelligible the conditions and habits of prospective buyers overseas. The Research Organisation would, of course, have to tackle its undertaking country by country, but a world investigation is indicated. Thereby each member company in the Federation could have the opportunity of seeing the entire export market as a whole, and could eventually decide on the type and style of goods it could best manufacture in volume sufficient to produce the goods at prices economic to itself and competitive in the markets designate.

A useful—in some cases a vital—extension of the research service would be the establishment of a dependable Advisory Selling Department, competent to effect trustworthy introductions to sales organisations or to report on existing or contemplated sales arrangements. Many export houses—or would-be exporting houses—in this country have had rueful experience of the need of such advice.

The financing of these Market Research Organisations should present no obstacle. It can be arranged by subscription of capital on fixed-interest terms. This interest could well be met, and the capital safeguarded, by the fees chargeable to the companies who buy the reports of the researches or otherwise avail themselves of the researches of the Research Organisations.

By such a plan as I have outlined, based on Lord Strathspey's original suggestion of federation, individual businesses would be in a comparable position to the large and successful organisations which have their own means of assessing the needs of a given overseas market and which control the distribution of their goods through all channels until they reach the ultimate consumer.

The result of the operation of such a plan would be, I believe, a vast expansion of the British export trade, an outcome which would not only provide work for our people, but would carry the prestige of Great Britain still deeper and farther afield. Demobilisation of the Forces and war industries may not be or it may be "just around the corner." The time to get all this enterprise under way is now.

H. E. SAWARD.

London, W.C.2, November 1st.

SIR,—In the tribute to the rubber industry which you publish from Lord Strathspey, and for which we are grateful to him, he urges the federation of other trade associations whose members, like our own, are dependent upon a common raw material. The recommendation is all the more important when applied to those industries likely to suffer from a temporary shortage of raw materials when the war is over. Raw material shortage means controlled allocations, and these, in turn, involve priorities. Such priorities can best be fixed in relation to an entire industry and should not be influenced by the competing claims of individual trade associations.

The rubber industry provides a good example. During the last year of peace it exported no fewer than twenty-six different products of a total value of £5,647,314. Assuming a temporary shortage of rubber after the war, which of these products should receive high priority of supply? Let us name a few of them: Tyres, footwear, sports goods, proofed garments, industrial equipment. Tyres will be important in the home market because transport is vital to reconstruction, and consequently to re-employment; yet although sports goods may appear to be inessential, in the last year of peace we sold overseas £146,087 worth of golf balls and £142,781 worth of tennis balls, which, apart from their export value, "carry the flag."

As in the rubber industry, so in others; decisions will have to be made, and, from a practical point of view, these may best be based upon the recommendations of federated trade associations representing every viewpoint.

H. L. KENWARD,
Chairman, Reconstruction Committee,
Federation of British Rubber and
Allied Manufacturers' Associations.

London, November 1st.

HYDROGEN IN BOILERS

SIR,—The letter from Engineer Vice-Admiral Sir George Preece is of interest, but still leaves me unconvinced that hydrogen was generated in the boiler.

If the tubes which fouled overheated through the presence of scale, there could not exist bare metal heated to a high temperature in the presence of steam—the requisite conditions for the generation of hydrogen. For the tubes to fail the walls must have been covered with scale, but, unless blocked, the tubes would still have been filled with water or, more correctly, the usual steam-water mixture, so that red-hot metal and steam could not have been in contact. If the tubes were blocked with scale, steam could not have been generated within them.

Even if the presence of red-hot metal is assumed, the generation of hydrogen in any quantity requires that the surfaces exposed should be swept by a continuous current of steam. If hydrogen was responsible for the explosion it must have been generated in considerable quantities, since it had passed through engines, condenser, and air pump, and then accumulated in the correct explosive concentration in the ventilating duct, in spite of the fact that the fan was running. It should be remembered that the ventilating duct was a downtake, and therefore presumably a fresh air inlet duct, through which the hydrogen would have to pass in a direction opposite to that of the air driven downwards by the fan.

Assuming that the gas did, in fact, accumulate in the duct, why did it burn quietly within

the motor commutator cover? In the circumstances, an explosion within the motor would not have been surprising. It is, of course, possible that motors of that time carried ventilating fans on the armature shafts and that a current of air was forced through the motor at a velocity higher than that of the rate of propagation of flame through explosive mixtures. If this is also assumed, there remains the surprising fact that the lambent, blue, non-luminous flame within the commutator cover should have been observed from engine-room floor level and that such an experienced man as the chief artificer, on going up the casing, mistook the flame for sparking at the brushes.

As to an alternative cause of the explosion, it is possible, although highly improbable, that inflammable vapour from the lubricating oil was responsible—improbable because of the downward current of air which would carry such vapour away from the fan motor. This suggestion was not put forward because the writer was inclined to regard the whole narration as a "leg pull," a yarn such as sailors love to tell to unsuspecting landlubbers.

It is interesting to note that in his letter Sir George Preece makes it clear that the explanation advanced was only conjecture "in the minds of those who examined it" (the boiler). Other theories could be advanced, but to carry conviction they must bear examination in the cold light of reason.

E. B. Parker.

Wirral, October 30th.

British Shipbuilding*

The War and Shipping

THE most dangerous chink in the armour of this country has been the vulnerability of its vital sea lines of communication and supply. Briefly, the proneness of its merchant shipping to attack by enemy submarines and aircraft. Criticism of the policy of producing ships of moderate speed in the largest numbers succeeded the most fulsome praise for the vigorous policy which had been initiated by Britain, by which such ships had been turned out in American yards in quantities sufficient to neutralise the depredations of the enemy U boats. No constructive proposals for the production of adequate numbers of sufficiently faster ships by a soon-enough date were offered, but fantastic proposals received much publicity. In this there was much of what our American friends aptly term "hind sense" or wisdom after the event, but all the while the Admiralty was evidently more realistically conscious of the dangers of the situation than any of the critics, and measures have been taken which have greatly mitigated the danger, while opportunity has also been found to increase the number of faster ships for services in which such vessels can be advantageously employed. I make bold to say that if we had concentrated on building faster ships during this war, with the inevitable result that a much fewer number would have been available, then our recent enormous amphibious operations might have been impossible. Even a 15-knotter can only be in one place at a time, and two 11-knotters are obviously of much greater value under some conditions than one 15-knotter. It is, however, far from my intention to suggest that criticism should not be made, but this will only be of value when it is based on that attention to detail and calculations which we, as engineers and shipbuilders, are accustomed to apply when designing our ships and engines.

After the War

In my last year's Address I said, in regard to the future of British shipbuilding, "I think you will agree that it must be left to some future Presidential Address to deal with the colossal and unforeseeable problems which I am sure we shall find ourselves confronted with in the post-war world"; but events have moved so rapidly that I feel myself impelled to say something on this matter, without attempting any definite prophecies. In Churchillian language, I feel a good and sober confidence in a prosperous future for our shipbuilding industry, but only if certain conditions are fulfilled, of which, to my mind, the most important are:—

(1) That the industry is conducted with the highest possible degree of technical efficiency, taking the fullest advantages of the immense possibilities of modern science.

(2) That the industry is staffed and managed only by the best brains available; that these men one and all receive only the best ordinary and technical education, and that the sources of this education be materially improved from those which have been available in the past. That every effort be made to provide proper and improved educational facilities for the workers in the industry, so that they may be enabled to understand and operate the more scientific methods which will be introduced.

(3) That all those employed in the industry are prepared to wipe the slate of all old customs and agreements where these would hamper the introduction and efficient and economical working of new plant and methods.

(4) That all concerned work together for the common good instead of one section striving to maintain and improve their position at the expense of others, as I fear has often been the case in the past.

Abandonment of Obsolete Trade Customs

Not all the research and reorganisation in the world will in themselves suffice to make the shipbuilding industry as efficient—and therefore as prosperous—as corresponding industries in other countries if we propose to operate the new plant and methods produced by our researches under the incubus of old customs and labour agreements, many of them dating from before the last war, and which, while no doubt reasonably satisfactory at the time, are quite inappropriate to the entirely new methods of to-morrow. If the British shipbuilders, with the advantage of their own and America's wartime experience of welding and other new processes, and with the aid of scientific research, produce a blueprint of the shipyard which will produce ships in the most efficient and economical manner, then it will be the duty of the leaders of the operatives to co-operate so as to enable the new plan to be put into being and operated in the most effective manner. It will be useless to expend large sums of money on new plant and up-to-date equipment if their operation is obstructed by insistence on maintaining old customs and demarcations quite inappropriate to the new plan.

It is disheartening and even alarming to see workers, even in the midst of war, fighting amongst themselves and even striking over demarcation questions. Tradesmen "X" and tradesmen "Y" each say that certain work has been theirs in the past, and that it must therefore remain theirs in the future, no matter how methods of working have changed, when they should be discussing who can do the job in the best and most economical manner from the point of view of production. This is an example of what I mean by old customs retarding progress. I have some confidence, however, that the modern labour leaders will take a broad and enlightened view of these problems, which appear to me to be of the greatest importance.

Economic Prospects

The guiding principle amid the complications should be that, as an island, this country should be abundantly supplied with ships. Further, that these ships should be built in this country and that the profession and industry of shipbuilding here should be so efficient that they will be called upon, as they have been for so many generations, to build ships for other countries. There can be no security and little prosperity for the people of this land without the practical adoption of this three-part principle, and as I believe all countries outside Germany and Japan are now fully convinced that a strong British Empire is essential for their own security, I think we are fairly entitled to ask them not to make a secure and reasonaby prosperous Britain impossible by any actions which would prevent us from maintaining the Mercantile Marine so vital to our needs.

The Shipping Business

The interests of our shipowner members and friends are very closely linked with our own in the problem of post-war planning. In common, we look forward to the day when private—or, as I would prefer to call it, "individual"—enterprise may be allowed to resume operation, while fully recognising that this is not wholly possible during the war or immediately following its conclusion. If, however, full benefit is to be obtained from the shipping and shipbuilding experience of the people of this country, it is, in my opinion, essential that builders and owners should be allowed as free a hand as is possible as soon as possible.

Conclusion

From all I have said it appears that it must still be left to some future President to attempt to forecast with any assurance the prospects of our industry after the war, but I trust that my observations may give some food for thought. There is an unwritten rule of the Institution that once a year the President may make some broad references to the economic, as distinct from the technical, aspects of engineering and shipbuilding. I trust I have not exceeded this licence; have not forgotten, in effect, that the Institution's principal task is the advancement of the sciences of engineering and shipbuilding and all that is therein implied. But we must avoid taking up a certain legacy available from the days of the last war—I mean a tendency to cant about science. The word then acquired an almost mystic aura and there was a flood of books on popular science. For us "science" means the use of exact methods in the design of ships and their engines; the methodical study of relevant phenomena; the methodical investigation of fields of information and the application of data there obtained. It involves a knowledge of and facility in the use of mathematics and physics—quite unnecessary in the perusal of popular science books.

I would emphasise that in the pursuit of engineering and shipbuilding we are engaged in a scientific occupation cluttered with the regrettable necessity of giving much time and labour to purely economic questions. In a technical society such as this, we see a practical attempt to marry a "debunked" science—a science as recognised by those engaged in it—to business. Two wars have shown that ultimately it is the scientific partner in this union that matters most, and my excuse—apart from the precedent mentioned earlier—for diverging into the side alleys of economics and State policy is the desire to ensure that, as shipbuilders and engineers, we shall be allowed the maximum freedom in contributing to the progress of civilisation.

* North-East Coast Institution of Engineers and Shipbuilders. From the Presidential Address of J. Ramsay Gebbie. October 15th.

Italy Looking for Power.—To offset the shortage of coal, Italy is developing her natural gas and methane resources. A natural gas main linking Piacenza and Milan was recently completed, and will supply Milan with gas. The city has also constructed a biological methane plant to give 50,000 cubic metres of gas per day. Attempts are also being made to utilise the large supply of maize waste for methane production.

New Steel Lifeboats for Tankers

IT was recently announced by the Ministry of War Transport that orders have now been placed for 500 steel lifeboats of a new type, specially designed for use in oil tankers. Almost a year ago, we may recall, the Ministry issued rules making it necessary for tankers to be equipped with steel lifeboats, and the delivery of these boats has continued. In some cases wooden boats have been exchanged for steel boats, while in others the wooden boats have been specially treated and rendered fire resisting. It can now be stated that all oil tankers which have been built since July, 1942, when the new rules were issued, have been equipped with steel lifeboats. The cost of these lifeboats is being defrayed by the Ministry, except in the case of new construction, when they form an integral part of the ship, for which in due course the owner pays. The new type of lifeboat, which we herewith illustrate, has been specially designed to mitigate the hazard of fire, which is, of course, an additional risk with oil-carrying ships. The comfort of the occupants of the lifeboats has been carefully studied and new ideas and improvements embodied. The design has been prepared by the Tanker Tonnage Committee of the Petroleum Board in collaboration with the Ministry of War Transport, and the principal particulars are as follows :—

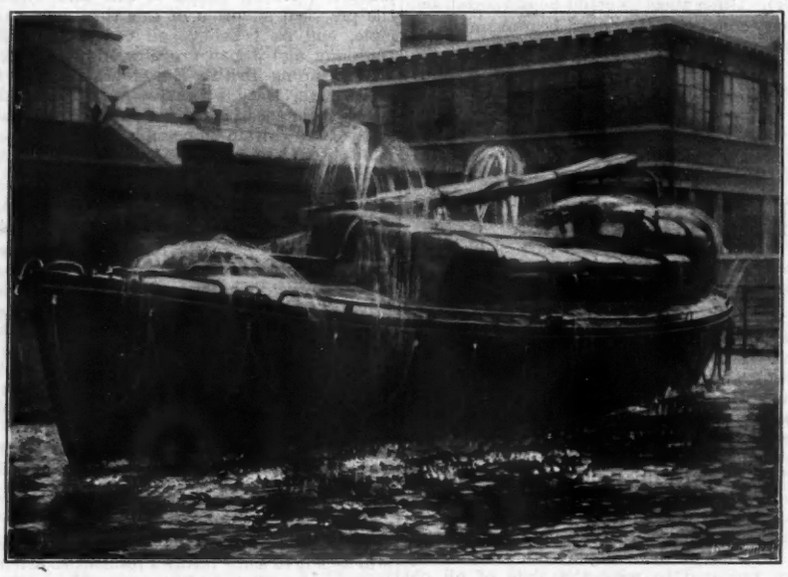

FIG. 1—STEEL LIFEBOAT WITH SPRAYS OPERATING

Overall length	28ft.
Length on water line	26ft.
Moulded breadth	9ft. 6in.
Depth moulded	3ft. 9in.
Seating capacity	33 persons
Total weight on davits fully equipped and manned ...	7¼ tons approx.
Means of propulsion : Fleming gear, " Victor Cub " oil engine or electric	
Speed with Fleming gear ...	About 3·3 knots
Speed with oil engine	About 5·5 knots

Some of the main features are indicated in the accompanying engraving and drawings. There is a raised turtle deck forward and aft, with a fireproof sliding canopy over the cockpit. All buoyancy tanks are of the built-in pattern, and considerable protection is afforded from both danger by fire and weather. As shown in Figs. 1 and 2, a complete system of water sprays is fitted for the protection of the deck and sides of the boat. The material of which the lifeboat is constructed consists of $\frac{1}{16}$in. plate for the keel, stem, and stern frame, while the hull bulkheads and deck are covered with metallised plates of 14 B.W.G. thickness. The canopy is made of double thickness asbestos cloth. The water is delivered to the sprayers by two hand pumps, each of which is designed to deliver about 30 gallons a minute. As will be seen from Fig. 3, the boats are rigged with a lug sail, jib, and missen. Three alternatives are provided for propulsion. They are Fleming hand-operated gear, and a " Victor Cub " oil engine, or electric propulsion which is being developed by the Ministry of War Transport. During tests made in a fully loaded condition a speed of about 5·5 knots with the oil engine in operation was attained, while with the Fleming gear a speed of 3·3 knots was recorded. It may be stated that each boat will carry a water distiller.

The decision to proceed to mass production of this new type of lifeboat was taken, we learn, after a series of exhaustive tests had been made by Ministry officials. They included a demonstration of the seating arrangements, the working of the water distiller, and the operation of a wireless transmitter with a kite aerial, which were followed by sailing, stability, and inclining tests.

The most important of these tests was, however, that which required the boat to be subjected to intense fire and smoke for a period of at least four minutes, in which it was estimated that the boat could be propelled—at least a quarter of a mile upwind—either by power or hand gear a distance which, it was felt, would generally be beyond the limit of the blazing oil covering the sea. It will be appreciated that the carrying out of such a test in open water presented considerable difficulties, and it was therefore decided to adapt a static water tank for that purpose in such a manner that the conflagration was controlled. During the first of the tests, which lasted four minutes, the boat was not manned and the spray pumps were operated from the bank, but with water passing through the spray piping and the sprayers. The drawing we reproduce in Fig. 2 shows the experimental arrangement of the sprayer with a detail of one of the spray nozzles. After successfully passing the first test some modifications were made, and a further test was then carried out, the boat being manned by personnel representing the interested parties. In neither test was the seaworthiness of the lifeboat or the efficiency of the fire protection impaired, although during the tests the boat was lost to view at times in smoke and flame which reached a height of 40ft. During this severe test the

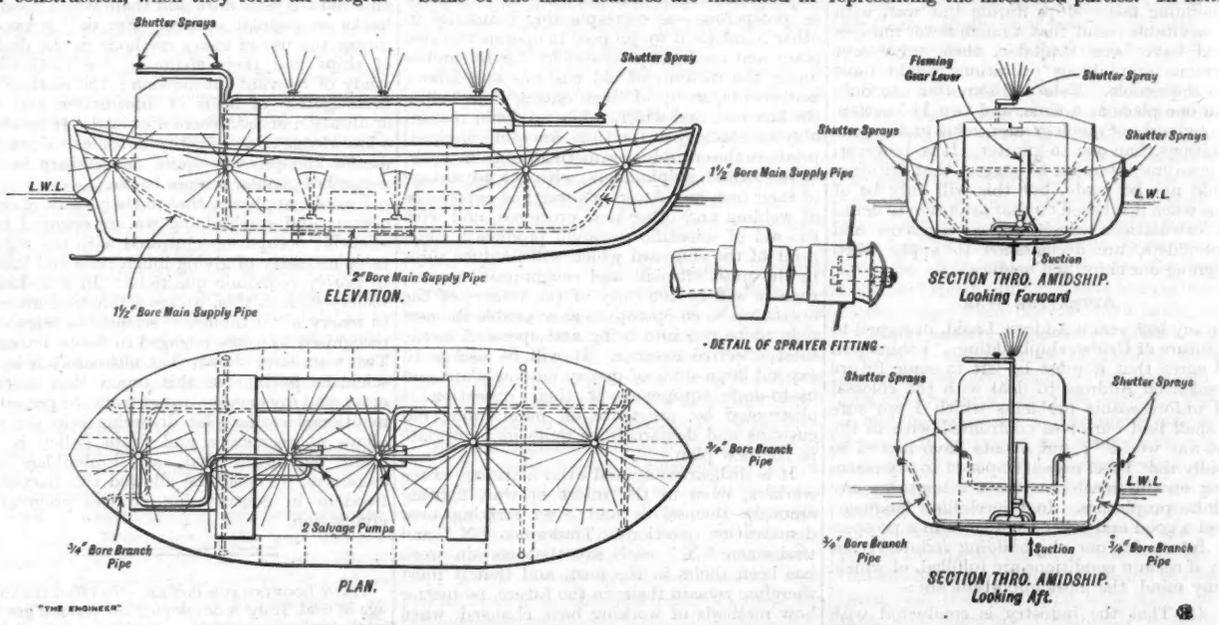

FIG. 2—ARRANGEMENT OF WATER SPRAYS OF STEEL LIFEBOAT

quenching and cooling effect of the water sprays, on which the safety of the boat and its occupants depended, was very noticeable. The occupants of the boat showed, moreover, no signs of distress after their ordeal, and they indicated that conditions never became unpleasant, even although the period of test was extended to five minutes. About half the number of boats on order are to be propelled by oil engines which will be arranged amidships, while the remainder will be propelled by Fleming hand gear or by means of electric propulsion. The motor used in electric propulsion is to be operated from a battery, which will have sufficient power and endurance to bring the boat away from the zone of fire. Attention has also been given to the installation of the boats in the ships and their launching.

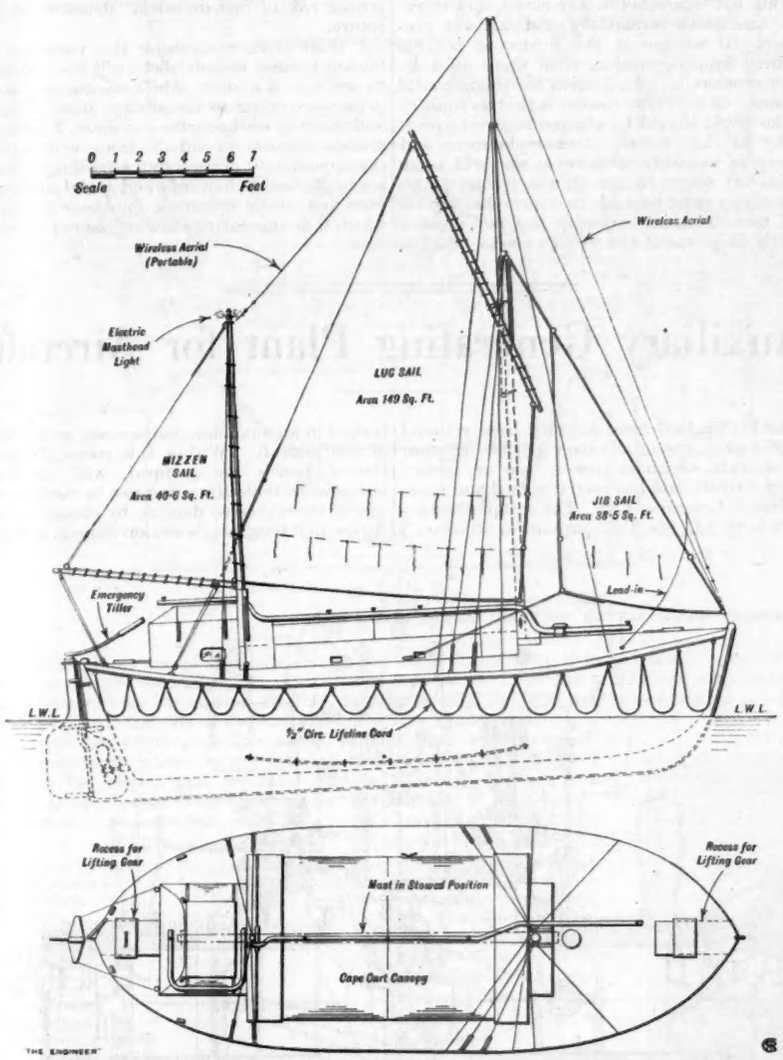

FIG. 3—ARRANGEMENT AND RIGGING OF LIFEBOAT

The Ministry has placed orders for a supply of gravity type davits of such design and strength as will enable the boats to be launched quickly from an inboard position and to be lowered fully loaded with their equipment and complement of men. The davits will be fitted with flexible steel wire falls, which are attached to the boat through quick-acting releasing gear. From the description and illustrations we are permitted by the Ministry to give it will be appreciated that a further important step has been taken to counter the fire risks which are inevitable when oil tankers are attacked by the enemy.

CORRECTION.—"Engineers and the British Empire," No. XVI, THE ENGINEER, October 22nd, page 331. We regret that Mr. Ranald J. Harvey's first name was inadvertently printed as Roland.

Industry and the Future

SIR GEORGE NELSON, President of the Federation of British Industries, on October 29th, addressed a meeting of Federation members in the Houldsworth Hall, Manchester, under the chairmanship of Mr. Harry Allcock, a Vice-President of the Federation and Chairman of the Manchester District Committee.

He asked, What are the prospects likely to be in the early post-war years? His answer, given after careful study backed by a good deal of inside knowledge, was that industry, given wise leadership and good judgment, would be able to offer steady employment to a maximum number of people for some years after the war. Continuing, he said our first charge therefore will be to apply our minds with confidence to the re-establishment of our industries on a normal basis as early as possible after the war. Then, during those busy first years, we should give thought and action to the organisation of continued stability of employment.

Many industrialists will be wondering what are likely to be the post-war commercial relations between the United States and this country. Naturally, the approach to the problem is affected by the facts of circumstance. After giving careful thought to the point, I have come to the following broad conclusion. In the first place, during the first few years after the war, the industries of both countries can be fully occupied in supplying the needs of their own people. But there will be other needs. We in Britain must provide the exports with which to pay for our essential imports. Speaking in the world sense, an urgent task before both countries will be to supply the devastated areas. As the industries of both countries can be fully employed on home demands, obviously export needs must be fixed by agreement between the two countries. From this, I am convinced, there will come an understanding on the question of developing world trade, an understanding that will result in agreement between the U.S.A., England, and Russia to encourage their home trade and to facilitate world trade.

Last year, as Chairman of the Tank Mission to Canada and America, I found the American Government, manufacturers, and experts so willing to co-operate that, I am quite sure, having co-operated in war, there will be found a basis for co-operation in peace.

CONTROLS

As for our domestic affairs, there is danger, when the war is won, in the fact that everybody will want to make long-delayed purchases. Supplies will be limited. Demand will be great. Hence the threat of inflation. To counter this threat, control of prices and rationing will have to continue, but on a diminishing scale, dependent on the rate with which supplies are built up. But controls and rationing must be brought to an end and trade operated in a normal fashion as early as possible.

Rationing and control of prices must be designed to prevent, during the period of demobilisation, the creation of productive capacity in excess of future normal requirements. By this means, we shall prevent the economic disaster that arose after the last war, when in certain industries capital was invested in productive machinery far in excess of normal needs. Perhaps I may cite motor-cars and textiles as two prominent examples of this process. Again, there must be no speculative dealings in productive units of the kind that affected the cotton industry and from which it has never recovered.

TAXATION

Taxation must be reduced as early as possible after the war and due relief given for depreciation on buildings, amortisation of patents and wasting assets, and adequate relief for research. The late Chancellor took notice of our representations to him, and instructed the Inland Revenue Department to examine the incidence of taxation on productive industry. The Federation has already submitted written recommendations, and will be giving oral evidence in due course.

It seems to me that depreciation allowances should be blocked for expenditure on the items for which they are allowed. I feel this strongly, for, when war came, in spite of the fact that allowances had been made for depreciation, plant and machinery in many factories was inefficient and obsolete.

PRIVATE ENTERPRISE

We cannot discuss the possibilities of the future without wondering what is likely to be the ultimate place of private enterprise. My own conviction is that private enterprise can and will play the greatest possible part if those responsible for its direction justify themselves by their actions and by the results achieved. Private enterprise does and can continue to serve the public better and at lower cost than nationalised industry.

Speaking for myself, I am quite convinced that if industry were to become nationalised we should become a second-class nation and our workpeople would not be able to retain their present standard of living. I do not say this because I am in any way opposed to nationalisation as a doctrine or because of vested interests, but from deep concern for the interests of the workpeople. I speak as one with a wide knowledge of industry, small and large, and with exhausting experience during the war of the frustration of individual initiative involved in the vast cumbrous system of Government control.

Nationalisation, we must not forget, would mean the gearing of industry to the State machine. Its speed would be that of the slowest

unit. Individual effort would not be free, and the individual would become a cog in a gigantic mechanism. I suggest there is no virtue in a nationalised institution, although operating without profit, if it means that the public pays more for the same product than it would if that product were made by private enterprise. It is not love of money or power that is the spur to those who are devoted to their business. It is pride of accomplishment. The greater the business, the more opportunities are given to provide those extra amenities for the meeting of sickness, premature death, and old age.

Profit, it must be remembered, is only a very small percentage of the selling price at the factory. It is also a measure of efficiency in a competitive market. The State shares in a very substantial degree the results arising from the efficiency, enterprise, and initiative of the managements, and the skill and energy of the workpeople. With taxation at the present level, at least half and often more of the results of these efforts go to the State.

No new trade or industry owes its origin to the State. State control does not have to pass efficiency tests. It survives in spite of itself and at the expense of the community. I am not suggesting that private enterprise makes no mistakes, but I do suggest that such mistakes as have been made have been nothing like as costly as those of statesmen and Government Departments. Industry under Government control would hesitate to take risks because of the possibility of criticism in Parliament. Those who had been used in business to the taking of quick decisions and prompt action would be frustrated because of the constant criticism of their shareholders, namely, the Members of Parliament. In the interests of the country and of its people, private enterprise must be encouraged. As safeguards against abuse, taxation should be designed to penalise exploitation and to encourage enterprise.

May I remind you that private enterprise is essentially the system of payment by results ? A private enterpriser backs his own opinion. If he is wrong, he, and any whom he may have been able to convince, stand the loss. They do not saddle it on the taxpayer. Private enterprise is the opposite of the slogans " Safety First " (if by that we mean no action or advance without cover) and " Business as Usual " (if by that we mean business that has always been done that way).

The aim of private enterprise is to get a job done and to supply a need. That is admittedly the prerequisite to earning a profit—payment for results. I think we may fairly say that the object of the civil servant and of " established " officials generally is to avoid censure. The pressing need of these times, particularly in old countries like Britain, and particularly, we may say, in democracies, is " more speed," and that is the one thing you can be sure of not getting from a State official. Let us take as an example of the contrast between private enterprise and State control, their different attitudes towards the collecting of information. If private enterprise seeks information about a potential customer, it takes its own steps to collect and record it. The first thing a bureaucrat does is to make the inquirer or potential customer fill up his own form.

These reflections must not be taken as derogatory to the Civil Service. I have the highest regard for its integrity and its ability to conduct the work for which it is trained. But I do maintain that this training and equipment are quite unsuitable for industrial world competition.

Organisation of Industry

I have dealt with the general principles which, it seems to me, should govern industry. We fully realise that private enterprise can only justify itself by results. It must be efficient. The Federation has quite recently laid special emphasis on one fundamental of industrial advance—research. Another task before us is to inquire how industry, as represented by the trade association movement, can best be organised. My view is that each section of industry should possess an efficient trade association to deal with its own domestic concerns. For the consideration of matters affecting the industry as a whole, those sections should co-operate either by establishing a joint committee or other form of organisation which would enable the whole industry to express its views. Progress has been made in this direction by many branches of industry, but much remains to be done.

Finally, the F.B.I., as the central body of industry, should consider questions which affect industry at the highest possible level, basing its conclusions on the views of the individual industries and sections of industries organised in the way I have outlined. Personally, I believe that such a system can be achieved by voluntary association, which I strongly support as the proper method of organisation for a democratic country like our own.

Cartels

I am not interested in any cartel, and therefore can speak impartially and without prejudice. If we are in the future to achieve security from aggression, then there must be some measure of cartelisation for fundamental reasons. One of these reasons is that no country in the world should be allowed to live in prosperity at the expense of unemployment and misery in another. Otherwise war will come again. It seems to me, in the second place, that efforts must be made to ensure that capital and manufacturing capacity are not created greatly in excess of the world's needs. Such a process ultimately promotes cut-throat competition and slumps. I will not argue here the details or the safeguards that will be necessary to maintain the urge to advance and achievement. Cartelisation should organise for efficient production with consequent lower prices to serve a country's needs and its share in world demand. Should this method also be associated with an economic price level, there is still wide scope for enterprise and initiative in service and quality. As I have said, I am not going into details, but proper provision is necessary against exploitation either nationally or internationally.

Cartelisation, I realise, cannot be applied to all types of industry. Moreover, I do not overlook the fact that the small and medium-sized units have played a great part in our industrial development and must continue to play their proper *rôle* in our industrial structure of the future.

I trust that, recognising the variations in human nature, industrialists will do their best to see that a system, which encourages every person according to his ability, justifies itself, and that the workpeople—for whom I have the greatest admiration and affection—will be given the opportunity of receiving according to their accomplishments rewards and social amenities over and above essentials for their existence, which it is imperative shall be assured to every man.

Auxiliary Generating Plant for Aircraft

PARTICULARS have recently been released of a new type of auxiliary generating plant for aircraft, which is now in use on certain larger aircraft, and has been designed and made by Rotol Airscrews, Ltd. The equipment provides both A.C. and D.C. current for all aircraft services, including the starting of the main engines. In the case of the larger machines it is usual to provide two complete auxiliary generating units, each of which is able to meet the total power requirements, the units being housed in an auxiliary engine-room in the body of the aircraft. Within this room the local control panels are grouped, with interconnections, so that either unit can be used should one of them receive damage by enemy action. At the flight engineer's station there is a remote control panel, enabling the load to be transferred from one unit to the other and the two sets started or stopped. These actions are entirely automatic in character, and the units are so designed that under service conditions they can

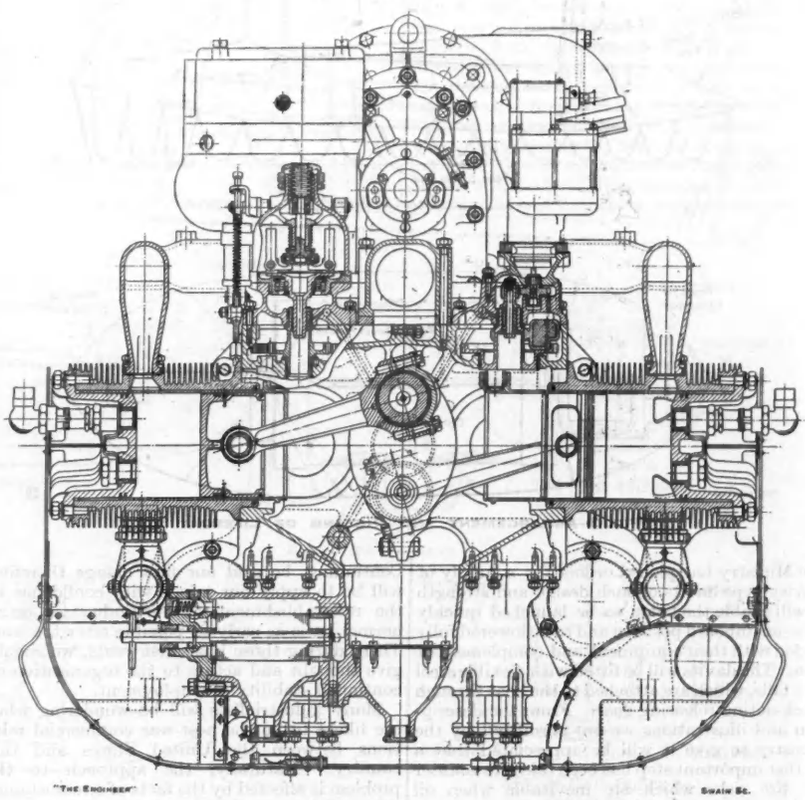

FIG. 1—CROSS-SECTION THROUGH ENGINE

be run over long periods without any attention.

In order to prevent any possibility of noise, fumes, or vibration being transmitted to the body of the aircraft, the generating unit is housed in a metal box, which is both sound and fireproof. A general view is reproduced in Fig. 3, which shows one of the units, complete in its box, on the metal stand. Two ducts from the box convey the cooling air from, and the heated air to, the side of the aircraft, both of the ends being conveniently located in a single streamlined blister on the side of the machine. The engine and generator unit is mounted in the box on rubber blocks, so that no vibration is transmitted. The lid, shown removed in our engraving, is hinged so that quick access is given to the mechanism of all parts. It will be noted that the box is supported on a tubular base, which raises it some inches from the floor. This arrangement allows connections to be taken out, without encroaching on additional space, and the provision of a bilge connection, so that the base can be washed out when required.

Engine Particulars

Type of engine	Horizontal opposed-piston
Number of cylinders ...	Six
Bore of cylinders	3·375in.
Piston stroke	3·0in.
Swept volume	2·64 litres, or 61 cub. in.
Compression ratio	7·8 to 1
Governed speed...	3750 r.p.m.
Rated altitude	12,000ft.
Designed output	60 B.H.P.
Type of fuel used	87 to 100 octane petrol
Fuel consumption	3 gallons per hour
Lubricating oil consumption...	0·80 pint per hour

Generator Particulars

Type of alternator	110-volt, three-phase, 250 cycles
Power factor	0·83
Designed running speed ...	3750 r.p.m.
Normal rated output ...	30 kW
Maximum 5-min. rating ...	32 kW
Type of D.C. generator ...	29-volt air-cooled machine
Designed running speed ...	4600 r.p.m.
Normal rated output ...	3 kW
Maximum 5-min. rating ...	4·8 kW

Weight and Dimensions

Weight, including base and box...	450 lb.
Length of box	42·75in.
Width of box	28·0in.
Height of box	32·5in.
Diameter of ducts	9in.

Engine Design

The engine, which was designed by Mr. D. R. Pobjoy, is coupled direct to the alternator. The D.C. generator is mounted above it, and is gear driven. The unit is complete with starter, air cooling fan, fuel and lubricating oil pumps. The inside of the box is lined with fireproof, sound-absorbent material, and to the outside of the box a Graviner fire extinguisher bottle is attached which is connected to a thermal switch with pipes for extinguishing fire. The principal technical particulars of the unit, which we show in longitudinal section and cross sectional drawings in Figs. 1 and 2, are given in the table.

The engine has six air-cooled cylinders, which are horizontally opposed in two groups of three. The cylinder casings are machined from light alloy and are bolted to a two-piece light alloy crank case. The opposing cranks are arranged at 180 deg., so that the cylinders are slightly staggered. Single sleeve valves are employed, the inlet manifold being on the top and the exhaust pipes below. The open ends of the cylinder casings are closed by the usual cylinder head carrying a projection with piston rings and furnished with two sparking plugs.

The six-throw crankshaft runs in four plain bearings and has a large ball bearing at the alternator end. The journals and crankpins are hollow and are nitrogen-hardened. The crankshaft is furnished with the usual drilled holes for lubricating oil. The steel connecting-rods have big end caps, which are held in position by two setscrews, the joint face being serrated. Bronze bushes are fitted to the small ends. Pistons are made of light alloy and carry two gas rings and two scraper rings, with a hollow floating gudgeon pin. The sleeve valves are operated by means of small cranks which are arranged vertically on the top of the crank

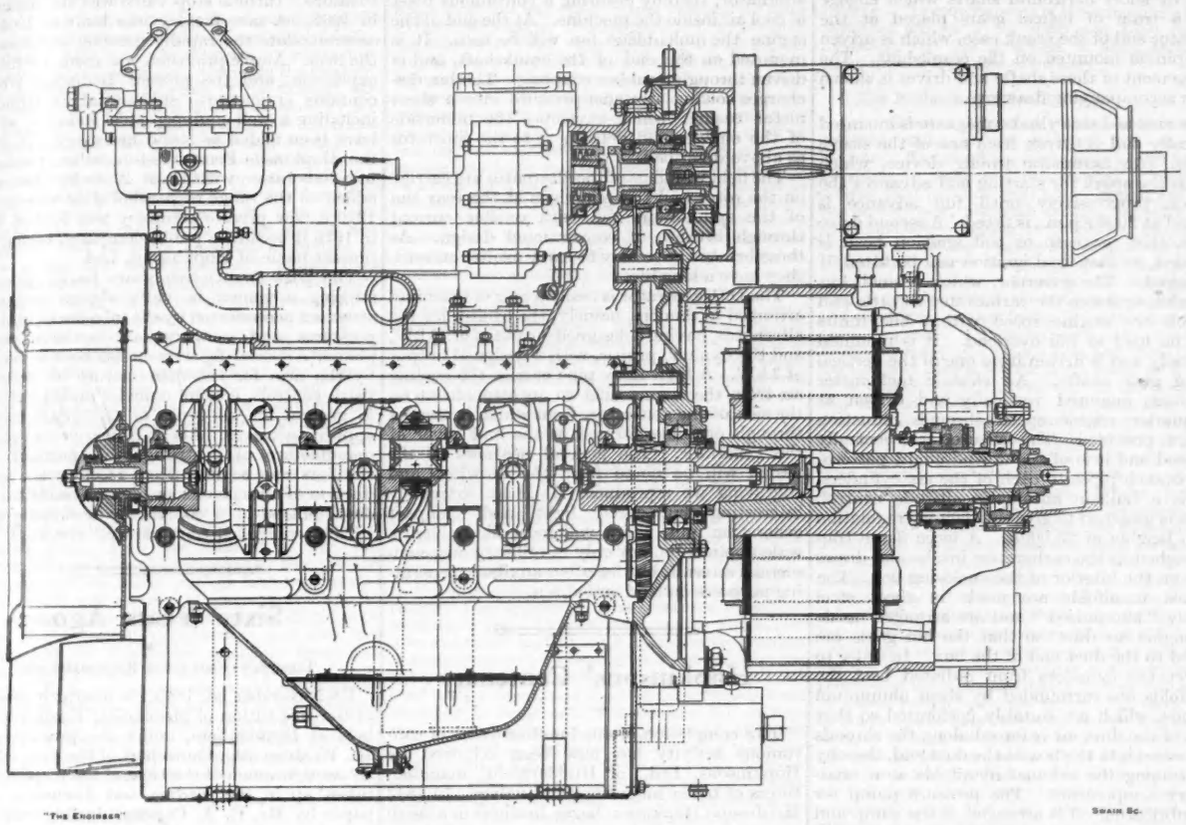

FIG. 2—LONGITUDINAL SECTION OF AUXILIARY GENERATING PLANT

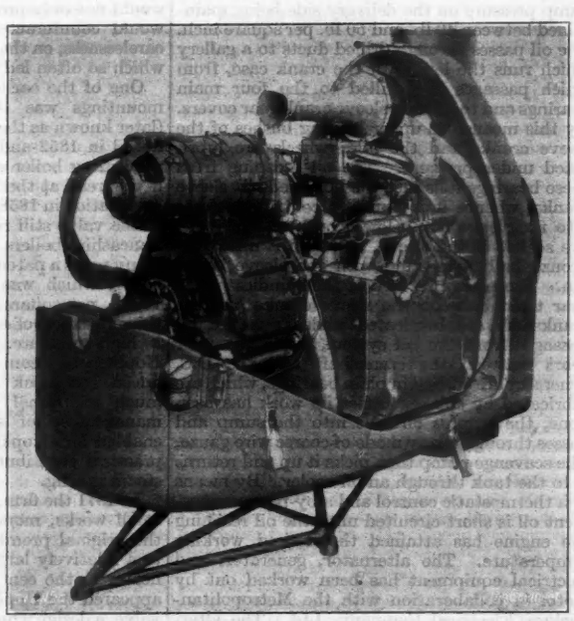

FIG. 3—COMPLETE GENERATOR UNIT

case. They are connected together by means of a train of gears from each bank of cylinders. Vertical spindles on either side drive the train of gears and at their lower ends also operate the scavenge and pressure oil pumps, which are carried in the crank case of the engine. These vertical shafts are driven through bevel gears by short horizontal shafts which engage with a train of helical gears placed at the generator end of the crank case, which is driven by a pinion mounted on the crankshaft. The arrangement of these shafts and drives is shown in the accompanying drawings.

The screened six-cylinder magneto is mounted vertically and is driven from one of the sleeve cranks. An automatic timing device, which retards the spark for starting and advances the ignition progressively until full advance is reached at 2000 r.p.m., is fitted. A second drive for another magneto or coil ignition head is provided, so that dual ignition can be fitted, if so desired. The governor, which is small but powerful, operates the carburetter throttle and controls the engine speed within fine limits from no load to full overload. It is mounted vertically and is driven from one of the vertical timing gear shafts. An electric tachometer generator, mounted vertically and driven at one-quarter engine speed through reduction gears, is provided. The carburetter is centrally disposed and it is of the downdraught pattern, with branch pipes to each of the six cylinders. It has a built-in automatic altitude control, which is designed to give satisfactory regulation up to heights of 25,000ft. A large flame trap is attached to the carburetter intake and draws air from the interior of the enclosing box. The exhaust manifolds are made in sheet steel heavily "aluminised" and are arranged inside the engine air duct, so that the hot gases are carried to the duct end of the box. In order to protect the cylinders from radiated heat the manifolds are surrounded by sheet aluminium shrouds, which are suitably perforated so that some of the duct air is forced along the shrouds and passes into the box at the duct end, thereby maintaining the exhaust manifolds at a satisfactory temperature. The pressure pump for the lubricating oil is arranged in the sump and it draws oil through a flexible pipe from the oil tank, delivering it into the self-cleaning filter which forms part of the pump body. A safety valve, permitting oil to be by-passed should the filter become choked, is fitted. At the side of the filter casing is a spring-loaded relief valve, which is at all times slightly open, the pump pressure on the delivery side being maintained between 40 lb. and 50 lb. per square inch. The oil passes through drilled ducts to a gallery which runs the length of the crank case, from which passages are drilled to the four main bearings and to the two sleeve crank gear covers. By this means the upper bearing bushes of the sleeve cranks and the idler wheels are lubricated under pressure. The oil escaping from these bearings falls into the hollowed-out sleeve cranks, whence it is flung by centrifugal force into the sleeve crank lower bush and into the eye socket of the sleeve, in which is a floating bronze ball connecting with the sleeve crank pin. The plain bearings of the spindles in the gear train between the sleeve cranks and the crankshaft are lubricated under pressure by passages from the oil system, while the idler gears between the crankshaft and the D.C. generator are carried in plain bearings, which are lubricated by splash. After its work has been done, the surplus oil falls into the sump and passes through a tray made of coarse wire gauze. The scavenge pump then picks it up and returns it to the tank through an oil cooler. By means of a thermostatic control and a by-pass arrangement oil is short-circuited until the oil reaching the engine has attained the desired working temperature. The alternator, generator, and electrical equipment has been worked out by Rotol in collaboration with the Metropolitan-Vickers Electrical Company, Ltd. The alternator consists of a stator, which is spigoted and bolted to the end of the engine crank case, and a rotor secured to the engine crankshaft. A light alloy cover closes the end of the stator and also houses a small ball bearing supporting the end of the rotor. A starting dog is fitted to the rotor at this point, which fits a detachable handle used for hand starting. The end cover has openings formed in it so that the cooling air can escape through them into the soundproof box. The air is supplied under pressure from the engine cooling air duct through large holes cast into the gear case, which put the duct into through communication with the inside of the alternator, thereby ensuring a continuous blast of cool air inside the machine. At the end of the engine the multi-blade fan will be seen. It is mounted on the end of the crankshaft, and is driven through a rubber coupling. The fan discharges cooling air under pressure into a sheet metal casing, which envelopes the underside of the engine, and delivers it to the generator as above described.

The field windings of the alternator are carried on the rotor and two slip rings at the rear end of the spindle are fed with exciter current through brushes of conventional design. As these brushes have only to carry exciter current, they have a long life.

The D.C. generator is really a pair of machines arranged in tandem, namely, the exciter for the alternator, having a designed output of 0·75 kW, and the dynamo proper, with a designed output of 3 kW. A light alloy pipe carries the cooling air from the engine duct to an attachment on the side of the generator, from which it escapes through openings formed in the end cover of the generator. The general neatness of the design will be noted from the drawings and engraving we reproduce. It is an extremely interesting high-speed light and compact generating unit, which will most likely have a wide application, not only in military and commercial aircraft, but for other auxiliary generating purposes on land and at sea.

Hopkinsons' Centenary

THE completion of one hundred years of continuous activity has now been achieved by Hopkinsons, Ltd., of Huddersfield, manufacturers of boiler mountings and valves. In 1843 Mr. Joseph Hopkinson began business in a small way as a manufacturer of engineering fittings, especially steam engine and boiler accessories, two four-roomed cottages serving as the original "Hopkinson" works. At that period much of the boiler equipment in use was crude and often dangerous, and there were the widest opportunities for the introduction of fittings which would not only prove reliable and efficient, but would counteract the ignorance and reckless carelessness, on the part of unskilled attendants, which so often led to deplorable accidents.

One of the earliest of the Hopkinson safety mountings was the compound safety valve (later known as the "Duad"), which was introduced in 1852 and proved highly successful in preventing boiler explosions. A description of it was read at the Leeds meeting of the British Association in 1858, and a modified arrangement of the valve still remains a standard fitting for Lancashire boilers. The firm manufactured for many years a patented economical self-cleansing boiler, which was claimed to work safely at 100 lb. per square inch at a period when anything in excess of 40 lb. was generally considered a high pressure. At about this time the Hopkinson steam engine indicator was produced. A book on this subject, containing much additional information concerning the management of steam engines and boilers, enabled Mr. Hopkinson to make an important practical contribution to the existing data on steam raising.

In 1871 the firm, which now occupied another small works, more conveniently situated than the original premises, transferred its activities to a relatively large factory off Viaduct Street, nearer to the centre of Huddersfield. In 1881 appeared the Hopkinson patented parallel slide valve, a design which has considerably influenced the general trend of stop valve design. The original valves were suitable for maximum pressures of 200 lb.; less than sixty years later parallel slide valves were standardised for steam pressures up to 2000 lb. In 1882 the principles of this type of valve were extended to blow-off valves, and subsequent applications have been incorporated in steam traps, condensate return traps, external water alarm, and other equipment. In 1890 the "Absolute" water gauge, fully automatic in both gauge arms, was produced, and 1892 saw the introduction of the "Tiad" stop valve, still widely used on Lancashire and Economic boilers. The "Centre-Pressure" turbine stop valve was standardised in 1903. A new factory was built in 1904 to accommodate the rapidly growing activities of the firm. Ample provision was made for future expansion, and the present Britannia Works contains numerous substantial extensions, including a well-equipped steel foundry, which have been added as found necessary. In 1904 the Hopkinson-Ferranti stop valve, produced in collaboration with Dr. S. Z. de Ferranti, was added to the range of parallel slide valves. In 1920 a new private company was formed, but in 1926 it became a public company, taking the present name of Hopkinsons, Ltd.

The past twenty-five years have witnessed striking advances in valve design and construction necessitated by the increase in working pressures and temperatures in large power plants. A special department has been developed by the firm for the manufacture of electrical valve controls, control cubicles and desks, and in general for all types of automatic control applied to valves. About fifteen years ago the manufacture of centrifugal oil purifiers and clarifiers was begun. More recently the introduction of a range of soot blowers has led to the development of a completely automatic electrically controlled soot blowing system.

Sixty Years Ago

TOWER'S FRICTION EXPERIMENTS

ON November 1st, 1883, the quarterly meeting of the Institution of Mechanical Engineers was held at Birmingham, under the presidency of Mr. Westmacott. Our report of the proceedings shows that much of the time of the meeting was taken up in the reading and discussion of a paper by Mr. E. A. Cowper, dealing with the inventions of James Watt and his models at Handsworth and South Kensington. Thereafter the Assistant Secretary read a paper on "Friction Experiments," by Mr. Beauchamp Tower, of London. There was nothing in our report to indicate that either we or the members present at the meeting realised that it was a historic occasion. Our report of the paper was highly condensed. It mentioned the difficulty which Tower had encountered in applying the lubricant to a bearing with a uniformity sufficient for accurate experimental purposes. All the common methods of lubrication had been found too irregular in their action. He had therefore adopted the method of making the bearing run immersed in a bath of oil, with the result that the bearing was always supplied with as much oil as it could take. Our condensed version of the paper said that after the experimental apparatus and the method of experimenting had been described, the results of the experiments were related. The only one of these results which we reported was the establishment of the alleged fact that the speed of minimum friction was from 100ft. to 150ft. per minute and that it increased with increasing load. From rest to the minimum friction speed the friction decreased, while above it the friction increased. Of Tower's other results we said nothing. Nevertheless, it was on them that Osborne Reynolds shortly afterwards based his hydrodynamical theory of lubrication, thereby laying the foundations of the whole modern theory of friction and lubrication.

PENNSYLVANIA RAILROAD IMPROVEMENTS.—The Pennsylvania Railroad has recently begun an improvement programme which is estimated to cost 3,500,000 dollars. This includes the construction of a new double track, 8 miles long, from 2 miles east of Pierron to 1 mile east of Smithboro, Illinois; the building of a new 540ft. bridge over Little Shoal Creek, between Pocahontas and Stubblefield, Illinois; and a number of siding additions and extensions and gradient separation projects.

Markets, Notes and News

The prices quoted herein relate to bulk quantities. Unless otherwise specified home trade quotations are delivered f.o.t. Export quotations are f.o.b. steamer.

Copper Development

The tenth annual general meeting of the Copper Development Association was held in London on October 27th, and was attended by representatives of member companies. Owing to the unavoidable absence of the Chairman of the Council, Mr. D. Owen Evans, M.P., the chair was taken by Mr. E. Pam, O.B.E. In his speech, the Chairman pointed out that this year's meeting marked the completion of the Association's first decade of successful operation, and that it was interesting to recall that when the Association was formed in 1933 it was one of the first of its type in this country. It had proved its value and it was significant that since its inception a number of other associations on substantially similar lines had come into being, testifying to the increasingly widespread realisation of the need for co-operative effort in development and the essential soundness of the basis on which the Association had been built up and operated. During the past ten years the Association had emerged from the experimental stage, and could now be regarded as an institution that had come to stay, the need for which would in the future most certainly be greater than ever before. Copper would undoubtedly be faced with greater competition from other materials than in any period hitherto, and would require the backing of all the research and development that could be brought to bear. In addition, many setbacks resulting from wartime conditions would have to be made good. Since the outbreak of war, the Association's activities had of necessity been greatly curtailed, but an active nucleus had been maintained which was capable of quick expansion. It was necessary that vigorous expansion should take place at the earliest opportunity, and that the activities of the Association should be developed to an extent even greater than that prevailing before the war. He hoped that members and others would continue to take an active interest in the Association and to contribute in every way possible to the furtherance of its objects, so that it might continue to prosper and increase in strength, prestige, and usefulness to the benefit of the whole industry.

The Pig Iron Market

Compared with, say, six months ago, foundries in this country are not so well employed as they were, but at the same time their pig iron requirements are on a considerable scale. The engineering and allied foundries and most of the jobbing foundries are occupied on work that is in some way connected with war production. The engineering foundries are the principal ones to feel the shortage of hematite, which, although it is in somewhat better supply, is still rather tight. The imports of high-grade ore from North Africa have enabled the production of this description to be increased, but the supply still falls short of the demand, and, in consequence, there is a steady request for pig irons that will answer as a substitute. The Iron and Steel Control finds it necessary carefully to supervise the distribution of hematite, and this iron is only distributed when no other kind of pig iron will answer the purpose for which it is required. Consumers are still hoping for a higher production and an easier supply position as larger quantities of high-grade ore become available from overseas. The light castings industry as a whole is probably better employed than at any time since the war began, but it is far from being fully employed. Recently, the industry's requirements showed some expansion, but this was due to a seasonal increase in the production of stoves and heating apparatus. The light castings foundries are the largest consumers of high-phosphoric pig iron and as this quality is produced from home ores the position has been easier than in other descriptions of pig iron. The absence of any export trade or home demand for the building materials which the light castings foundries normally produce has severely hit this industry, and there is not likely to be any permanent improvement in their rate of employment until the war is over. Refined and low-phosphoric pig iron is in somewhat better supply, and the demand, as a result of changes in the war production programme, has become slightly easier. Consumers therefore are generally able to obtain their requirements without undue difficulty. The huge production of steel requires a heavy production of basic pig iron, and this the producers have been able to maintain.

Scotland and the North

The state of the Scottish steel makers' order books makes it evident that from now until the New Year the industry will have to work at full capacity. There is a heavy tonnage of orders in hand for plates and offers of new business continue to reach the makers. Few, however, can be accepted for delivery in 1943. The shipyards are taking the largest proportion of the output of plates, but other industries are important consumers, and their requirements are on a large scale. All the industries associated with the shipyards are fully employed, and are using big tonnages of steel in one way or another. The marine engineers are particularly busy, and their steel requirements will be heavy for a long time. Consumer's pressure to obtain light sections is unrelaxed, and the orders in the hands of the steel makers and re-rollers amount to a large total, and there is an insistent pressure for delivery. There is not a great deal of business passing in heavy joists and sections because the Government's building programme has passed its peak, and no important fresh work has come forward to take its place. Manufacturers of power plants also are big consumers of various descriptions of steel products, and the requirements of armaments makers have for a long time taxed the resources of the steel works. It is fortunate that the semi-finished steel position has greatly improved over the past few weeks. The re-rollers are now obtaining regular deliveries and all the material they want. At the same time they are still using defectives, and some works have built up stocks of these against an emergency. The withdrawals from the stocks of imported American semis, which at one time were a feature of the position, have practically ceased. The demand for bars, both large and small, seems to be expanding, and large quantities are moving to the engineering industry, but the call for ferro-concrete bars appears to have weakened somewhat recently. Great activity rules in the Lancashire iron and steel market, and considerable pressure is being exercised by consumers to obtain supplies from the works. The demand for light structural steel has increased, and delivery dates show a fresh tendency to lengthen. The demand for colliery steel is well maintained, and considerable tonnages of props, arches, and light rails are being taken up by the mining industry. There is a heavy demand for alloy steel, but the increase in the production which occurred earlier in the year enables producers to meet consumers' requirements. Busy conditions rule at the steel works on the North-West Coast and the works are assured of full operation in all departments during the current year.

The North-East Coast and Yorkshire

Although consumers' requirements of all descriptions of iron and steel do not appear to have slackened in any way, the flow of business has been checked, principally because consumers do not find it easy to place fresh orders for delivery in the current delivery period. Most of the steel works on the North-East Coast are fully booked until the end of the year, and only the most urgent priority orders can be accepted for reasonably early delivery. Under these circumstances, the production of iron and steel stands at a high level and the industry in this district is confident of being able to meet consumers' requirements, heavy as they will be during the remainder of the year. With ample supplies of raw materials at hand, it seems unlikely that any serious difficulties in the maintenance of deliveries will arise. Nevertheless, there is continual pressure for steel supplies to enable the rolling mills to maintain their high production. A large production of special steel has been achieved, and this is principally devoted to satisfying the requirements of the armaments and aircraft makers. There is an insistent demand for all descriptions of semi-finished steel, and large quantities of billets, blooms, and sheet bars are passing into consumption. The output of semis has been increased, and not only are the re-rolling works kept fully supplied, but the call upon the stocks of imported semis has been greatly reduced. The demand for plates has shown no sign of declining and there is a large volume of business passing in light sections and small steel bars, although the somewhat unfavourable situation in the heavy structural steel department has not improved. The demand for heavy joists, &c., is poor, and the makers are able in most cases to give comparatively near delivery. Conditions in the Yorkshire iron and steel industry are similar to those ruling in other parts of the country. There is a heavy production of basic steel, and the makers have order books which will keep them busy until the end of the year. The raw materials position is satisfactory, however, and there is little likelihood of production falling off. The demand for acid carbon steel has shown signs of increasing lately, and the plant producing this description is fully occupied. The volume of business in alloy steel has increased of late after a period of rather quiet trading. The requirements of the armaments manufacturers are on a big scale and have recently increased, but the producers of alloy steel have maintained a high rate of delivery.

The Midlands and South Wales

There has been no relaxation in the great activity ruling in the Midland iron and steel industry. The re-rolling works have a large tonnage of orders in hand, and are assured of busy conditions until well into next year. Supplies of semis are satisfactory, although reports are current of some difficulties arising in deliveries, owing to a shortage of railway wagons, but this seems to have affected only one or two districts, and has not been of a serious nature. A number of the re-rolling works have been able to accumulate stocks of primes and defectives, and are facing the winter period in a good position. Deliveries from the stocks of American semis held by the Iron and Steel Control have almost ceased for the time being, as a result of a considerable improvement in the output of English and Welsh works. The activities of the re-rollers are largely concentrated upon the production of light structural angles, small steel bars, and special sections. Nearly all the re-rolling works have heavy commitments, and are taking up large tonnages of semi-finished steel. Whilst there has been no slackening in the demand for plates, large quantities of which are reaching the shipyards, the position in the heavy structural steel sections has not improved. Heavy joists and sections are in comparatively poor demand. The call for sections is principally for the lighter sizes, and the delivery dates for these show a tendency to lengthen. There is an active demand for sheets and most of the works order books are rather congested, so that new orders are not easily placed. Business in colliery steel is active, and the mines are taking up their full quotas of arches, roofing bars, and props. The steel works in South Wales have full order books, and are not anxious to book fresh business for delivery before the early part of next year. There is great pressure upon the works producing steel plates, and efforts are being made to increase production. The works producing billets and sheet bars are operating at capacity and are experiencing considerable pressure from consumers. The sheet makers have full order books for delivery during the current period, and it is difficult to place new business. The tinplate industry in South Wales, as a result of the revival in demand, is fairly well occupied, but recently new business has not been active. Export business has been negligible.

Iron and Steel Scrap

Recently difficulties of transport have created some disturbances in the iron and steel scrap trade. Many traffic restrictions have now been modified; but, as recently as last week, there were troubles in delivery owing to a shortage of railway wagons. In other respects, however, the market seems to have become brighter and more activity is noticeable in several descriptions of iron and steel scrap. The demand is still principally for the heavier and better sorts, and any parcels of this description coming on the market are quickly taken up. Good heavy mild steel scrap in furnace and foundry sizes has a strong demand, but supplies are somewhat on the short side. Steel makers have shown a readiness to take in all offerings of bundled steel scrap and hydraulically compressed steel shearings that are offered. There are good supplies of mild steel turnings, but consumers show a tendency to discriminate rather sharply and whilst good heavy and chipped descriptions are disposed of without much difficulty, other sorts are finding a somewhat slow market. There is a fair amount of activity in wrought iron steel scrap for basic steel furnaces, and good heavy material is not so abundant as it was and the demand has strengthened. Light material is in rather poor demand, but there is no lack of supplies. Good stocks are held by many consumers and the volume of new business in this description is not large. The demand for compressed basic bundles has improved considerably of late and a moderate trade is passing. The cast iron scrap position has altered very slightly. Supplies are not more than sufficient to meet the demand, which has been good of late and is strengthening. Good cast iron scrap in large pieces and furnace sizes is freely taken up and there is a brisk trade passing in the lighter sorts. Business in good cast iron machinery scrap in cupola sizes appears to have fallen off somewhat, as a number of consumers have covered their allocations. Difficulties are still experienced in disposing of bushy turnings, but less of these are coming on the market.

Notes and Memoranda

Air and Water

A Timber Bridge.—A timber bridge consisting of six 129ft. truss spans with steel gusset plates has been built across a channel of the Ohio River near Pittsburgh. The bridge is supported on timber piers carried on piles and rock-filled cribs. The trusses were assembled on barges and erected one at a time by a floating rig.

South Africa Salvages a Cargo.—The South African Engineer Corps has salvaged the cargo of a steamer wrecked off the Cape Peninsula. Included in the 3000 tons of military cargo recovered were several tanks. A private firm of contractors worked with the engineers, but before the cargo could be taken out some repair work had to be done. Air compressors were erected on the shore and also a large derrick for lifting the tanks and other heavy cargo from the holds and lowering them into barges. The tanks have since been reconditioned and put into military service.

Institution of Naval Architects.—The annual general meeting of the Institution of Naval Architects will be held on Wednesday, March 29th, 1944. Other dates on which meetings will be held are to be announced later. The Council will be pleased to consider papers on subjects relating to naval architecture or marine engineering. Such offers—or suggestions for papers on matters of interest to the Institution—should be sent in before the end of November. A list of papers selected for reading and discussion will be issued later, and in due course advance copies of the papers will be available.

America's Next Big Dam.—The construction of the Fort Gibson dam on Grand River, Okla., is to be begun as soon as tenders can be secured. An appropriation of 8,400,000 dollars was made by Congress in 1942 for the dam, primarily as a flood-control structure, but the money was frozen when non-essential construction was stopped by the war. The fund now has been released, and materials for building the dam will be made available. The dam will be 2950ft. long, 110ft. high at its highest point, and will have an average height of 85ft. There will be seventeen flood gates and fourteen other openings to provide for the normal discharge of the river.

The Jumna River.—According to *Indian Engineering*, a scheme to bring back and keep the river Jumna to its right bank is being examined by the Technical Committee appointed by the Central Government to investigate the problem of water scarcity in Delhi. The scheme has been evolved at the Central Irrigation and Hydro-Dynamic Research Institute at Poona and aims at laying a pitching along the river for about one mile, of which a little more than half would be above the power station and the remainder below. Model experiments conducted at Poona seem to indicate that the proposed pitching would be successful. This measure, it is hoped, will be found useful as an immediate solution of the problem of water scarcity in Delhi. The Technical Committee will report on these and other measures to prevent scarcity of water in Delhi in the next and subsequent hot seasons.

Miscellanea

Death of Mr. C. E. Johansson.—The death of Mr. Carl Edward Johansson, inventor of Johansson gauge blocks and other precision instruments, occurred in the United States on September 30th. He was seventy-nine years of age. The gauge blocks were first made by Mr. Johansson in 1896 at Eskilstuna, Sweden. Within a short time the gauge blocks proved to be both a technical and commercial success, and twenty years ago Mr. Henry Ford acquired the manufacturing rights for the gauges and established Mr. Johansson and his associates in a modern laboratory. As a result the Johansson gauges became readily accessible, not only to the Ford organisations everywhere, but also to the entire scientific and manufacturing world.

Institution of Production Engineers.—At the annual general meeting of the Institution of Production Engineers, held last Friday, October 29th, at Grosvenor House, London, Sir Stafford Cripps, Minister of Aircraft Production, addressed the members. He pointed out first that engineers because they were members of a profession had a duty, not solely to their employers, but also to the workers and the community at large. That led him on to speak of the relations between the managers and the workers in a factory, and he stressed the value to a factory of a harmoniously working Works Committee. Such Committees should neither be forums merely for the airing of workers' grievances nor should they be used by managements solely for informing the workers what it was intended should be done. In a good Works Committee the workers should be drawn in and consulted on managerial problems to which from their intimate knowledge of the shops they could provide much of value. Works Committees so used could do much to increase confidence and trust between management and men. Sir Stafford also spoke of the value of works suggestions schemes.

Tantalum in the U.S.A.—Recently released figures relating to the production of tantalum in America record unprecedented output in 1942. Total net sales were 65 per cent. above 1941 and 255 per cent. above 1940. During the year a large plant was constructed by Tantalum Defence Corporation, at a cost of over 4,000,000 dollars, with funds supplied by the U.S. Government. This plant is now in operation under lease, and its output has already exceeded rated capacity.

Cape Town Plans for the Post-War Period.—The City Council and municipal officers of Cape Town are proposing in the first ten post-war years to spend over £30,000,000 on various works and development schemes. These will include the completion of the new Dock Road power station and certain extensions to the electricity system, the completion of the Athlone sewage plant, various reclamation schemes, the building of important roads, bridges, and subways, the new Steenbras pipe line and filtration plant, new housing schemes, a new wholesale market, sports grounds and swimming baths, abattoirs, hospitals, the new civic centre, and other major undertakings essential to the city.

Industrial Safety Boots.—Industrial workers who are prone to foot accidents have hitherto been able to obtain buying permits to enable them to purchase safety boots with reinforced toes. Demand for these boots has now increased beyond the present rate of production. Every effort is being made to increase production still further, but in the meantime it is essential to see that the first priority for these boots is given to miners employed underground, amongst whom foot accidents are generally more numerous and severe than among any other group of workers. The Board of Trade has therefore decided that for a period of three months as from October 12th no further buying permits for safety boots will be granted to any but underground miners, and even then only in cases of real necessity.

Personal and Business

Mr. R. F. Summers has been appointed a director of the London Midland and Scottish Railway Company.

Mr. W. Turnbull and Mr. Alan Greig have been appointed directors of Blyth Dry Docks and Shipbuilding Company, Ltd.

Mr. A. Gouge, B.Sc., F.R.Ae.S., President of the Royal Aeronautical Society, has joined the board of Saunders-Roe, Ltd., flying boat builders. Mr. H. E. Broadsmith, M.I.N.A., F.R.Ae.S., and Captain E. D. Clarke, joint managing directors, and Mr. H. Knowler, A.M. Inst. C.E., F.R.Ae.S., chief designer, are also members of the board. Mr. Gouge has been elected vice-chairman.

Sunsaloon Bodies, Ltd., Birmingham, has gone into voluntary liquidation, and a new company, Weston Works (Birmingham), Ltd., has been registered in its place. This change has been principally occasioned by the many developments of the company's interests in fields of precision engineering other than those covered by the previous title. Weston Works (Birmingham), Ltd., will continue under the same direction and management. The governing director is Mr. D. A. Pearson.

Mr. Arthur Brampton has resigned his position as chairman of the Renold and Coventry Chain Company, Ltd., and the board has appointed the managing director, Mr. C. G. Renold, to the chairmanship in his stead. Mr. Brampton is retaining his seat on the board. He has filled the office of chairman ever since the formation of the company in 1930, when Hans Renold, Ltd., the Coventry Chain Company, Ltd., and Brampton Brothers, Ltd., were merged. Mr. C. G. Renold is resigning his position as managing director, and the board has appointed Mr. R. O. Herford to that position. Mr. Herford, who has been the works director of the company for many years, has been loaned by the company to the Ministry of Supply as Controller of Inspection (Administration), and will assume the duties of managing director as soon as he is released by the Government.

Forthcoming Engagements

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Monday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

Association for Scientific Photography

Saturday, Nov. 13th.—Inst. of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2. "Electrical Engineering: The Photography of Cathode Ray Oscillograph Traces," N. Hendry and W. Nethercot. 2.30 p.m.

Bradford Engineering Society

Monday, Nov. 15th.—Technical College, Bradford. "The Effect of the New Educational Plans on the Engineering Industry," H. L. Haslegrave. 6.45 p.m.

British Coal Utilisation Research Association

Wednesday and Thursday, Nov. 10th and 11th.—Inst. of Mechanical Engineers, Storey's Gate, Westminster, S.W.1. Conference on Problems in the Utilisation of Small Coals. 2.30 p.m. (Wednesday), 10 a.m. (Thursday).

Illuminating Engineering Society

Tuesday, Nov. 9th.—E.L.M.A. Lighting Service Bureau, Savoy Hill, W.C.2. "The Lighting of Public Buildings," W. T. F. Souter. 5 p.m.

Institute of Transport

Friday, Nov. 12th.—Connaught Rooms, Great Queen Street, Kingsway, W.C.2. Luncheon and address by P. Noel Baker. 12.45 for 1.15 p.m.

Institute of Welding

Wednesday, Nov. 10th.—Inst. of Civil Engineers, Great George Street, Westminster, S.W.1. "Welding Applied to Track Work on the L.M.S. Railway," H. O'Neill and N. W. Swinnerton. 4 p.m.

Institution of Electrical Engineers

Monday, Nov. 8th.—N. Eastern Centre: Neville Hall, Westgate Road, Newcastle-upon-Tyne. "The Protection of Structures Against Lightning," J. F. Shipley. 6.15 p.m.

Tuesday, Nov. 9th.—London Students: Savoy Place, Victoria Embankment, W.C.2. Chairman's Address, "Remote Control of Traction Supplies," J. D. McNeil. 7 p.m.—S. Midland Students' Section: Association Hall, English Electric Company, Stafford. "Turbo-Alternator Ventilation," H. R. Ogle. 7 p.m.

Institution of Engineers and Shipbuilders in Scotland

Tuesday, Nov. 9th.—39, Elmbank Crescent, Glasgow. "Welding Applied to Stud Link Chain Cables," T. Scott Glover. 6.30 p.m.

Institution of Locomotive Engineers

To-day, Nov. 5th.—Connaught Rooms, Great Queen Street, Kingsway, W.C.2. Luncheon. 12.15 p.m.

Institution of Mechanical Engineers

Thursday, Nov. 11th.—Scottish Branch: Royal Technical College, Glasgow. "Remember the Past and Look to the Future," Professor F. C. Lea. 7.30 p.m.—N. Western Branch: Engineers' Club, Albert Square, Manchester. "District Heating and Post-War Reconstruction," Dr. W. Kulka. 6.45 p.m.

Friday, Nov. 12th.—Scottish Branch: Robert Gordon's Technical College, Aberdeen. "Remember the Past and Look to the Future," Professor F. C. Lea. 7.45 p.m.—Storey's Gate, Westminster, S.W.1. Symposium on the Reclamation of Worn Parts. 5.30 p.m.

Institution of Production Engineers

To-day, Nov. 5th.—Coventry Section: Technical College, Coventry. "Powder Metallurgy," W. D. Jones. 6.45 p.m.

Saturday, Nov. 6th.—Yorks Section: Great Northern Hotel, Leeds. "Plastics," C. R. Williams. 2.30 p.m.

Junior Institution of Engineers

To-day, Nov. 5th.—39, Victoria Street, Westminster, S.W.1. "The Synchrophone as an Aid to Post-War Training," N. Sandor. 6.30 p.m.

Friday, Nov. 12th.—39, Victoria Street, S.W.1. Annual general meeting. 6.30 p.m.

Keighley Association of Engineers

Friday, Nov. 12th.—Victoria Hotel, Keighley. "The Young Production Engineer: His Training and Prospects," J. D. Scaife and J. Hill. 7.30 p.m.

Liverpool Engineering Society

Wednesday, Nov. 10th.—Municipal Annexe, Liverpool. "Works Accidents," G. E. Windeler. 6 p.m.

Manchester Geological and Mining Society

Tuesday, Nov. 9th.—5, John Dalton Street, Manchester. Ordinary meeting. 2.45 p.m.

National Smoke Abatement Society

To-day, Nov. 5th.—Caxton Hall, Westminster, S.W.1. Annual general meeting. 10 a.m.

Royal Society of Arts

Wednesday, Nov. 10th.—John Adam Street, Adelphi, W.C.2. "Education To-day and To-morrow: English Education as It Is," P. R. Morris. 1.45 p.m.